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TRANSACTIONS

OF THE

AMERICAN DENTAL ASSOCIATION

AT THE

TWENTY-FIFTH ANNUAL SESSION,

HELD AT MINNEAPOLIS,

COMMENCING ON THE 4TH OF AUGUST, 1885.

PUBLICATION COMMITTEE:

GEO. H. CUSHING. A. W. HARLAN. E. T. DARBY.

PHILADELPHIA:
THE S. S. WHITE DENTAL MANUFACTURING CO.
1885.

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The American Dental Association, although formally accepting and publishing the reports of the various Standing Committees and the essays read before the Association, holds itself wholly irresponsible for the opinions, theories, or criticisms therein contained, except when otherwise decided by special resolution.—*Constitution.*

PRESS OF PATTERSON & WHITE,
PHILADELPHIA.

LIST OF OFFICERS FROM DATE OF ORGANIZATION.

PRELIMINARY CONVENTION, NIAGARA FALLS, AUGUST, 1859.

President,	W. W. ALLPORT . . .	Chicago.
Secretary,	J. TAFT	Cincinnati.

ORGANIZATION AND FIRST SESSION OF ASSOCIATION, WASHINGTON, D. C., JULY, 1860.

[Annual meetings to be hereafter last Tuesday in July.]

President,	W. H. ATKINSON . . .	Cleveland.
1st Vice-President,	J. B. GIBBS	Washington, D. C.
2d Vice-President,	W. CAHOON	Detroit, Mich.
Recording Secretary,	J. TAFT	Cincinnati.
Corresponding Secretary,	W. MUIR ROGERS . . .	Shelbyville, Ky.
Treasurer,	S. DILLINGHAM . . .	Philadelphia.

[NO MEETING IN 1861.]

CLEVELAND, JULY, 1862.

President,	GEO. WATT	Xenia, Ohio.
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2d Vice-President,	W. D. STONE . . .	Lexington, Ky.
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Corresponding Secretary,	J. F. JOHNSTON . . .	Indianapolis.
Treasurer,	W. A. PEASE . . .	Dayton, Ohio.

PHILADELPHIA, JULY, 1863.

President,	W. H. ALLEN . . .	New York City.
1st Vice-President,	J. H. MCQUILLEN . .	Philadelphia.
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Corresponding Secretary,	C. R. BUTLER . . .	Cleveland.
Treasurer,	A. C. HAWES. . . .	New York City.

NIAGARA FALLS, JULY, 1864.

President,	J. H. MCQUILLEN . . .	Philadelphia.
1st Vice-President,	C. P. FITCH	New York City.
2d Vice-President,	H. BENEDICT	Detroit.
Recording Secretary,	J. TAFT	Cincinnati.
Corresponding Secretary,	GEO. W. ELLIS . . .	Philadelphia.
Treasurer,	I. J. WETHERBEE . . .	Boston.

LIST OF OFFICERS.

Chicago, July, 1865.

President,	C. W. Spalding	St. Louis.
1st Vice-President,	Geo. H. Cushing	Chicago.
2d Vice-President,	Jas. McManus	Hartford.
Recording Secretary,	J. Taft	Cincinnati.
Corresponding Secretary,	L. D. Shepard	Boston.
Treasurer,	I. J. Wetherbee	Boston.

Boston, July, 1866.

President,	C. P. Fitch	New York City.
1st Vice-President,	W. H. Morgan	Nashville.
2d Vice-President,	L. D. Shepard	Boston.
Recording Secretary,	J. Taft	Cincinnati.
Corresponding Secretary,	A. Hill	Norwalk, Conn.
Treasurer,	W. W. Sheffield	New London, Conn.

Cincinnati, July, 1867.

President,	A. Lawrence	Lowell, Mass.
1st Vice-President,	P. G. C. Hunt	Indianapolis, Ind.
2d Vice-President,	A. S. Talbert	Lexington, Ky.
Recording Secretary,	J. Taft	Cincinnati.
Corresponding Secretary,	C. R. Butler	Cleveland.
Treasurer,	W. H. Goddard	Louisville, Ky.

Niagara Falls, July, 1868.

President,	Jonathan Taft	Cincinnati.
1st Vice-President,	Homer Judd	St. Louis.
2d Vice-President,	A. A. Blount	Springfield, Ohio.
Recording Secretary,	Edgar Park	St. Louis.
Corresponding Secretary,	Jas. McManus	Hartford.
Treasurer,	W. H. Goddard	Louisville.

Saratoga Springs, August, 1869.*

President,	Homer Judd	St. Louis.
1st Vice-President,	S. J. Cobb	Nashville.
2d Vice-President,	C. E. Francis	New York City.
Recording Secretary,	M. S. Dean	Chicago.
Corresponding Secretary,	I. A. Salmon	Boston.
Treasurer,	W. H. Goddard	Louisville.

* Owing to a change in the Constitution, officers elected at this and the sessions following served at the next annual meeting subsequent to their election; and the sessions of and after 1869 commenced on the first Tuesday in August.

NASHVILLE, AUGUST, 1870.

President,	W. H. MORGAN . . .	Nashville.
1st Vice-President,	S. W. DENNIS . . .	San Francisco.
2d Vice-President,	J. R. WALKER . . .	New Orleans.
Recording Secretary,	M. S. DEAN	Chicago.
Corresponding Secretary,	I. A. SALMON . . .	Boston.
Treasurer,	W. H. GODDARD . . .	Louisville.

WHITE SULPHUR SPRINGS, VA., AUGUST, 1871.

President,	GEO. H. CUSHING . . .	Chicago.
1st Vice-President,	C. E. FRANCIS . . .	New York City.
2d Vice-President,	J. R. WALKER . . .	New Orleans.
Recording Secretary,	M. S. DEAN	Chicago.
Corresponding Secretary,	I. A. SALMON . . .	Boston.
Treasurer,	W. H. GODDARD . . .	Louisville.

NIAGARA FALLS, AUGUST, 1872.

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1st Vice-President,	L. D. SHEPARD . . .	Boston.
2d Vice-President,	G. A. MILLS	Brooklyn, N. Y.
Recording Secretary,	M. S. DEAN	Chicago.
Corresponding Secretary,	J. TAFT	Cincinnati.
Treasurer,	W. H. GODDARD . . .	Louisville.

PUT-IN-BAY, AUGUST, 1873.

President,	T. L. BUCKINGHAM . .	Philadelphia.
1st Vice-President,	ISAIAH FORBES . . .	St. Louis.
2d Vice-President,	A. F. MCLAIN . . .	New Orleans.
Recording Secretary,	M. S. DEAN	Chicago.
Corresponding Secretary,	J. TAFT, ...	Cincinnati.
Treasurer,	W. H. GODDARD . . .	Louisville.

DETROIT, AUGUST, 1874.

President,	M. S. DEAN	Chicago.
1st Vice-President,	GEO. W. KEELY . . .	Oxford, Ohio.
2d Vice-President,	J. S. KNAPP	New Orleans.
Recording Secretary,	C. STODDARD SMITH . .	Springfield, Ill.
Corresponding Secretary,	GEO. L. FIELD . . .	Detroit.
Treasurer,	W. H. GODDARD . . .	Louisville.

NIAGARA FALLS, AUGUST, 1875.

President,	A. L. NORTHROP . . .	New York City.
1st Vice-President,	H. J. MCKELLOPS . .	St. Louis.
2d Vice-President,	H. A. SMITH	Cincinnati.
Recording Secretary,	C. STODDARD SMITH . .	Springfield, Ill.
Corresponding Secretary,	J. H. MCQUILLEN . .	Philadelphia.
Treasurer,	W. H. GODDARD . . .	Louisville.

PHILADELPHIA, AUGUST, 1876.

President,	GEO. W. KEELY	Oxford, Ohio.
1st Vice-President,	C. N. PEIRCE	Philadelphia.
2d Vice-President,	CORYDON PALMER	New York City.
Recording Secretary,	C. STODDARD SMITH	Springfield, Ill.
Corresponding Secretary,	J. H. MCQUILLEN	Philadelphia.
Treasurer,	W. H. GODDARD	Louisville.

CHICAGO, AUGUST, 1877.

President,	F. H. REHWINKEL	Chillicothe, Ohio.
1st Vice-President,	L. D. SHEPARD	Boston.
2d Vice-President,	GEO. T. BARKER	Philadelphia.
Recording Secretary,	M. S. DEAN	Chicago.
Corresponding Secretary,	M. H. WEBB	Lancaster, Pa.
Treasurer,	W. H. GODDARD	Louisville.

NIAGARA FALLS, AUGUST, 1878.

President,	H. J. MCKELLOPS	St. Louis.
1st Vice-President,	L. D. SHEPARD	Boston.
2d Vice-President,	L. D. CARPENTER	Atlanta, Ga.
Recording Secretary,	GEO. H. CUSHING	Chicago.
Corresponding Secretary,	A. O. RAWLS	Lexington, Ky.
Treasurer,	W. H. GODDARD	Louisville.

NIAGARA FALLS, AUGUST, 1879.

President,	L. D. SHEPARD	Boston.
1st Vice-President,	C. N. PEIRCE	Philadelphia.
2d Vice-President,	GEO. L. FIELD	Detroit.
Recording Secretary,	GEO. H. CUSHING	Chicago.
Corresponding Secretary,	M. H. WEBB	Lancaster, Pa.
Treasurer,	W. H. GODDARD	Louisville.

BOSTON, AUGUST, 1880.

President,	C. N. PEIRCE	Philadelphia.
1st Vice-President,	W. C. BARRETT	Buffalo.
2d Vice-President,	GEO. J. FRIEDRICHS	New Orleans.
Recording Secretary,	GEO. H. CUSHING	Chicago.
Corresponding Secretary,	A. M. DUDLEY	Salem, Mass.
Treasurer,	W. H. GODDARD	Louisville.

NEW YORK, JULY, 1881.

President,	H. A. SMITH	Cincinnati.
1st Vice-President,	W. C. BARRETT	Buffalo.
2d Vice-President,	GEO. J. FRIEDRICHS	New Orleans.
Recording Secretary,	GEO. H. CUSHING	Chicago.
Corresponding Secretary,	A. M. DUDLEY	Salem, Mass.
Treasurer,	W. H. GODDARD	Louisville.

CINCINNATI, AUGUST, 1882.

President,	W. H. GODDARD . . .	Louisville.
1st Vice-President,	GEO. J. FRIEDRICHS . .	New Orleans.
2d Vice-President,	E. T. DARBY	Philadelphia.
Recording Secretary,	GEO. H. CUSHING . .	Chicago.
Corresponding Secretary,	A. W. HARLAN . . .	Chicago.
Treasurer,	GEO. W. KEELY . . .	Oxford, Ohio.

NIAGARA FALLS, AUGUST, 1883.

President,	E. T. DARBY . . .	Philadelphia.
1st Vice-President,	C. S. STOCKTON . . .	Newark, N. J.
2d Vice-President,	T. T. MOORE . . .	Columbia, S. C.
Recording Secretary,	GEO. H. CUSHING . . .	Chicago.
Corresponding Secretary,	A. W. HARLAN . . .	Chicago.
Treasurer,	GEO. W. KEELY . . .	Oxford, Ohio.

SARATOGA SPRINGS, AUGUST, 1884.

President,	J. N. CROUSE . . .	Chicago.
1st Vice-President,	M. W. FOSTER . . .	Baltimore.
2d Vice-President,	C. F. RICH	Saratoga.
Recording Secretary,	GEO. H. CUSHING . .	Chicago.
Corresponding Secretary,	A. W. HARLAN . . .	Chicago.
Treasurer,	GEO. W. KEELY . . .	Oxford, Ohio.

MINNEAPOLIS, AUGUST, 1885.

President,	W. C. BARRETT . . .	Buffalo, N. Y.
1st Vice-President,	L. C. INGERSOLL . . .	Keokuk, Iowa.
2d Vice-President,	A. T. SMITH	Minneapolis, Minn.
Recording Secretary,	GEO. H. CUSHING . .	Chicago, Ill.
Corresponding Secretary,	A. W. HARLAN . . .	Chicago, Ill.
Treasurer,	GEO. W. KEELY . . .	Oxford, Ohio.

EXECUTIVE COMMITTEE FOR SESSION OF 1886.

J. N. CROUSE, Chairman. A. M. DUDLEY, Secretary.

FIRST DIVISION—COMMITTEE OF ARRANGEMENTS.

J. N. CROUSE, *W. N. MORRISON, L. D. SHEPARD.

SECOND DIVISION—CREDENTIALS AND AUDITING COMMITTEE.

A. M. DUDLEY, *S. G. PERRY, A. O. HUNT.

THIRD DIVISION—VOLUNTARY ESSAYS.

C. N. PEIRCE, *GEO. J. FRIEDRICHS, A. H. THOMPSON.

*These go out in 1886.

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MINUTES OF TRANSACTIONS

OF THE

AMERICAN DENTAL ASSOCIATION.

SESSION OF 1885.

BY GEO. H. CUSHING, Secretary.

FIRST DAY—MORNING SESSION.

THE American Dental Association commenced its Twenty-fifth Annual Session in Curtiss Hall, Minneapolis, Minnesota, on Tuesday, August 4, 1885, at 11 o'clock A. M., the President, J. N. Crouse, in the chair.

The roll of members was then called, and the following were found either to be present or to have forwarded their dues:

Atkinson, W. H.	41 East Ninth st., New York.
Abbott, Frank	22 West Fortieth st., New York.
Allen, E. H.	Freeport, Illinois.
Allport, W. W.	242 Wabash ave., Chicago, Ill.
Ames, W. B.	34 Monroe st., Chicago, Ill.
Austin, J. F.	125 State st., Chicago, Ill.
Abbott, J. T.	Manchester, Iowa.
*Bishop, J. Adams	32 West Thirty-sixth st., New York.
*Bödecker, C. F. W.	60 East Fifty-eighth st., New York.
Brown, S. B.	Fort Wayne, Indiana.
Barrett, W. C.	11 West Chippewa st., Buffalo, N. Y.
*Butler, C. R.	519 Euclid ave., Cleveland, Ohio.
*Baird, W. H.	Burlington, Iowa.
Bauer, Joseph	130 Esplanade st., New Orleans, La.
Brown, E. Parmly	Flushing, Long Island, N. Y.
*Boice, Alonzo	1612 Vine st., Philadelphia, Pa.

* Those marked thus were absent, but sent their dues.

d Those marked thus were delegates, and not permanent members.

Brophy, Truman W.	125 State st., Chicago, Ill.
Baldwin, J. H.	529 Second st., Louisville, Ky.
Baldwin, A. E.	828 W. Adams st., Chicago, Ill.
Barker, Chas. C.	Meriden, Conn.
Begun, A. R.	Cedar Falls, Iowa.
Baily, C. M.	208 Central ave., Minneapolis, Minn.
Buckner, M. L. S.	Shelbyville, Ky.
Bigelow, A. T.	St. Paul, Minn.
Brower, E. D.	Lemars, Iowa.
Brooks, E. L.	Vinton, Iowa.
Brown, Geo. V. I.	St. Paul, Minn.
Brown, A. E.	1536 Wabash ave., Chicago, Ill.
Bell, J. R.	55 Euclid ave., Cleveland, Ohio.
Bethel, L. P.	Akron, Ohio.
*Brackett, C. A.	102 Touro st., Newport, R. I.
*Bogue, E. A.	29 East Twentieth st., New York.
*Beck, C. S.	Wilkesbarre, Pa.
*Bullock, C.	569 Main st., Cambridgeport, Mass.
*Brown, Ira	225 Detroit st., Cleveland, Ohio.
*Brockway, A. H.	13 Greene ave., Brooklyn, N. Y.
Cushing, George H.	34 Monroe st., Chicago, Ill.
Crouse, J. N.	2101 Michigan ave., Chicago, Ill.
*Chaim, M. L.	18 Cooper Union, New York.
*Clifton, W. R.	Waco, Texas.
*Cleland, James	31 State st., Detroit, Mich.
d. Cutler, A. B.	Osage, Iowa.
Chittenden, C. C.	Madison, Wis.
Carr, Wm.	35 W. Forty-sixth st., New York.
Case, C. S.	Jackson, Mich.
Clements, S. T.	Faribault, Minn.
*Clement, C. W.	Manchester, N. H.
*Clapp, Dwight M.	62 Trinity Terrace, St. James st., Boston, Mass.
*Colgrove, W. H.	Johnstown, N. Y.
Call, E. B.	Peoria, Ill.
Crary, W. H.	382 Wabash st., St. Paul, Minn.
*Colton, Aaron	Hudson, N. Y.
*Cook, C. D.	133 Pacific st., Brooklyn, N. Y.
*Cowie, Henry	Detroit, Mich.
*Dennis, S. W.	530 Sutter st., San Francisco, Cal.
Darby, E. T.	1513 Walnut st., Philadelphia, Pa.
*Dunn, Charles E.	Louisville, Ky.
Dudley, A. M.	304 Essex st., Salem, Mass.
Daboll, G. C.	Buffalo, N. Y.
Davenport, L. C.	Moorhead, Minn.
Dillingham, E. B.	328 Nicollet ave., Minneapolis, Minn.
Doud, A.	Ft. Scott, Kansas.
Davis, L. L.	524 Van Buren st., Chicago, Ill.

Dyer, W. C.	2512 Wabash ave., Chicago, Ill.
Douglass, B.	Appleton, Wis.
Doyle, B. Oscar	735 W. Jefferson st., Louisville, Ky.
Dickinson, W. P.	Dubuque, Iowa.
*Devore, J. H.	Corry, Pa.
*Dutch, Wm.	24 Montgomery st., San Francisco, Cal.
*Dorrance, W. H.	Ann Arbor, Mich.
*Freeman, S. A.	14 Court st., Buffalo, N. Y.
*Farrar, J. N.	Apartment No. 1 Rensselaer, cor. Broadway and Thirty-second st., New York.
*Fundenberg, W. H.	323 Penn ave., Pittsburg, Pa.
Field, George L.	Detroit, Mich.
Friedrichs, G. J.	155 St. Charles st., New Orleans, La.
Foster, M. W.	48 Franklin st., Baltimore, Md.
*Freeman, A. W.	N. W. cor. State and Madison sts., Chicago, Ill.
*Fillebrown, Thomas	Portland, Maine.
Fuller, George W.	Des Moines, Iowa.
Fuller, A. H.	2626 Washington ave., St. Louis, Mo.
Fullerton, L. K.	Waterloo, Iowa.
Finney, W. B.	77 N. Eutaw st., Baltimore, Md.
*Finley, M. F.	Washington City, D. C.
*Guilford, S. H.	1513 Walnut st., Philadelphia, Pa.
*Gaylord, E. S.	New Haven, Conn.
Gardiner, Frank H.	126 State st., Chicago, Ill.
Gilmer, T. L.	Quincy, Illinois.
Graves, E. L.	559 W. Madison st., Chicago, Ill.
Guffin, E. L.	125 State st., Chicago, Ill.
d. Garber, S. A.	Tipton, Iowa.
*Hawes, E. P.	Providence, R. I.
*Hoysradt, G. W.	Ithaca, N. Y.
*Holmes, E. S.	Grand Rapids, Mich.
Hooper, J.	644 Fourth ave., Louisville, Ky.
Harlan, A. W.	70 Dearborn st., Chicago, Ill.
Honsinger, E.	318 Park ave., Chicago, Ill.
How, W. Storer	Chestnut st., cor. Twelfth, Phila., Pa.
Hunt, A. O.	Iowa City, Iowa.
Horton, W. P.	177 Euclid ave., Cleveland, Ohio.
Hill, S. J.	Fargo, Dakota.
Hayward, T. T.	1227 Hennepin ave., Minneapolis, Minn.
Hughes, E. E.	Des Moines, Iowa.
Hardman, J.	Muscatine, Iowa.
Haskell, L. P.	125 State st., Chicago, Ill.
Hewitt, C. B.	Kansas City, Mo.
Howe, A. O.	Washington C. H., Ohio.
*Harroun, C. H.	Toledo, Ohio.
*Horne, R. F.	Watertown, Mass.
Ingersoll, L. C.	Keokuk, Iowa.

*Jackson, H. H.	317 Jefferson ave., Detroit, Mich.
Jackson, V. H.	6 East One Hundred and Twenty-sixth st., New York.
Jenison, M. G.	Minneapolis, Minn.
*Jefferis, C. R.	Wilmington, Del.
*Keech, E. P.	Baltimore, Md.
Keely, George W.	Cor. High and Main sts., Oxford, Ohio.
*Keely, Charles I.	Cor. High and Third sts., Hamilton, Ohio.
*Kingsbury, C. A.	1119 Walnut st., Philadelphia, Pa.
Keith, H. H.	1515 Washington ave., St. Louis, Mo.
Kulp, W. O.	Davenport, Iowa.
Kulp, J. S.	Muscatine, Iowa.
Klump, George W.	3 West Third st., Williamsport, Pa.
Kimball, R. H.	429 Orchard st., Chicago, Ill.
Kitchen, C. A.	Rockford, Ill.
Knight, Henry A.	306 Nicollet ave., Minneapolis, Minn.
King, S. H.	Lincoln, Neb.
Knepper, G.	Marshalltown, Iowa.
Kelley, D. E.	Ashtabula, Ohio.
Kester, P. J.	628 Lake st., Chicago, Ill.
*Knowles, Saml. E.	S. E. cor. Post and Dupont sts., San Francisco, Cal.
*Leiter, Thos. C.	Wadsworth, Ohio.
Lathrop, Joseph	152 Woodward ave., Detroit, Mich.
Lyon, L. W.	Ryan Hotel, St. Paul, Minn.
Ludwig, R. F.	125 State st., Chicago, Ill.
*Litch, Wilbur F.	1627 Chestnut st., Philadelphia, Pa.
*McElhaney, G. W.	Columbus, Ga.
Morrison, W. N.	1337 Washington ave., St. Louis, Mo.
McManus, James	Hartford, Conn.
McKellops, H. J.	2630 Washington ave., St. Louis, Mo.
*Moore, E. C.	27 Lafayette ave., Detroit, Mich.
Moore, T. T.	Columbia, S. C.
Maercklein, B. G.	Iron Block, Milwaukee, Wis.
Marshall, John S.	242 Wabash ave., Chicago, Ill.
d. Macfarlane, S. S.	642 Penn ave., Pittsburg, Pa.
Matteson, A. E.	3700 Cottage Grove ave., Chicago, Ill.
Morsman, A.	Iowa City, Iowa.
Monfort, J. B.	Fairfield, Iowa.
Morgan, W. H.	Nashville, Tenn.
Martin, W. J.	181 W. Madison st., Chicago, Ill.
Miller, G. W.	Winterset, Iowa.
Martindale, J. H.	414 Nicollet ave., Minneapolis, Minn.
McCausey, Geo. H.	Janesville, Wis.
Moore, S. J.	Mitchell, Dakota.
Marriner, J. Frank	Ottawa, Ill.
McMillen, D. J.	720 Main st., Kansas City, Mo.
Maercklein, Robt.	Iron Block, Milwaukee, Wis.

*Morgan, Henry W.	Nashville, Tenn.
Noble, H. B.	600 Thirteenth st., Washington, D. C.
*Northrop, A. L.	44 West Forty-sixth st., New York.
Noyes, Edmund	65 Randolph st., Chicago, Ill.
Newby, Jas. B.	2640 Washington ave., St. Louis, Mo.
Nickson, E. D.	Humboldt, Iowa.
Nelson, N.	230 Milwaukee ave., Chicago, Ill.
*Odell, F. M.	7 West Thirty-eighth st., New York.
Ormsbee, W. W.	Geneva, Illinois.
*Perry, S. G.	46 West Thirty-seventh st., New York.
*Palmer, J. W.	Fitchburg, Mass.
Peirce, C. N.	1415 Walnut st., Philadelphia, Pa.
*Page, W. E.	Room 11, Studio Building, Boston, Mass.
Patterson, J. D.	S. W. cor. Eighth and Main sts., Kansas City, Missouri.
Pruyne, Charles P.	70 Dearborn st., Chicago, Ill.
Patrick, John J. R.	Belleville, Ill.
Peterson, C. J.	Dubuque, Iowa.
Prosser, A. J.	1605 Olive st., St. Louis, Mo.
d. Patten, Mark H.	Springfield, Illinois.
*Priest, A. N.	Utica, N. Y.
*Rehwinkel, F. H.	Chillicothe, Ohio.
Rhone, J. W.	Bellefonte, Pa.
Rhein, M. L.	7 W. Thirty-eighth st., New York.
Richter, R. G.	128 Wisconsin st., Milwaukee, Wis.
Reid, J. G.	30 McCormick Block, Chicago, Ill.
d. Ross, M. H.	Hampton, Iowa.
Rhein, B. L.	243 State st., Chicago, Ill.
Ross, F. R.	Cedar Rapids, Iowa.
Reid, H. M.	Minneapolis, Minn.
*Stevens, S. G.	85½ Broad st., Lynn, Mass.
*Smith, Eugene H.	283 Dartmouth st., Boston, Mass.
*Starbuck, W. C.	Jamaica Plain, Mass.
Smith, H. A.	128 Garfield Place, Cincinnati, Ohio.
*Shepard, L. D.	100 Boylston st., Boston, Mass.
Stockton, C. S.	Newark, N. J.
Swain, E. D.	65 Randolph st., Chicago, Ill.
Spalding, C. W.	1525 Olive st., St. Louis, Mo.
Swasey, J. A.	3003 Michigan ave., Chicago, Ill.
Smith, A. T.	258 First ave., Minneapolis, Minn.
Stewart, W. C.	Elmira, N. Y.
Spaulding, J. H.	506 Nicollet ave., Minneapolis, Minn.
Shirley, W. M.	Hiawatha, Kansas.
Smith, W. B.	279 Warren ave., Chicago, Ill.
d. Stone, E. C.	Galesburg, Illinois.
Southwell, C. C.	110 Wisconsin st., Milwaukee, Wis.
Smith, H. J.	Quincy, Illinois.
Southwell, C. P.	304 Grand ave., Milwaukee, Wis.

SMITH, J. H.	New Haven, Conn.
SPAULDING, W. A.	Minneapolis, Minn.
SITHERWOOD, GEO. D.	118 W. Washington st., Bloomington, Ill.
*TOLEDO, M. V.	113 E. Eighteenth st., New York City.
THOMAS, G. R.	Detroit, Michigan.
TAFT, J.	122 W. Seventh st., Cincinnati, O.
*TRUEMAN, W. H.	900 Spruce st., Philadelphia, Pa.
TIMME, C. A.	170 Hudson st., Hoboken, N. J.
TIBBETS, C. J.	Quincy, Illinois.
THOMPSON, A. H.	Topeka, Kansas.
TALBOT, EUGENE S.	125 State st., Chicago, Ill.
*VIET, MARTIN	12 Dauphine st., New Orleans, La.
VAN VALZAH, ROBERT	401½ Main st., Terre Haute, Ind.
VOSBURGH, J. BARKER	254 W. Fifth st., St. Paul, Minn.
*WHITE, SAML. A.	Savannah, Ga.
WATLING, J. A.	Ypsilanti, Mich.
WENDELL, W. C.	Iron Block, Milwaukee.
WILSON, I. P.	Burlington, Iowa.
*WATKINS, S. C. G.	Mont Clair, N. J.
*WADSWORTH, T. A.	159 W. Thirty-fourth st., New York.
WALKER, WILLIAM WALLACE	67 W. Ninth st., New York.
*WALTON, J. C.	Howell, Mich.
WASSALL, J. W.	208 Dearborn ave., Chicago, Ill.
WADSWORTH, E. C.	53 Bedford ave., Brooklyn, N. Y.
WATERS, T. S.	Baltimore, Md.
WELCH, JAMES M.	St. Paul, Minn.
WASSON, L. C.	Ottawa, Kansas.
WHITSLAR, W. H.	Youngstown, Ohio.
WHEELER, T. B.	255 Thirty-first st., Chicago, Ill.
WEEKS, THOS. E.	301 Nicollet ave., Minneapolis, Minn.
WINDER, R. B.	140 Park ave., Baltimore, Md.
WILLIAMS, J. B.	Fox Lake, Wis.
WILLIAMSON, F. A.	Red Wing, Minn.
*WATERS, GEO. F.	8 Beacon st., Boston, Mass.
*WILLIAMS, I.	New Philadelphia, Ohio.
*WERNER, J. G. W.	41 Upton st., Boston, Mass.

Any inaccuracies in the above list, in name or location, should be reported to the Treasurer at once, in order that the necessary correction may be made.

Annual dues being payable in advance, no name appears on above list except of those who have paid for 1885, and Transactions are not sent to any who have not fully paid their dues.

Do not send personal check when remitting dues.

On motion, the reading of the minutes was dispensed with.

On motion, a recess of ten minutes was taken to enable members to pay their dues.

At the expiration of the recess business was resumed, and the

Committee on Credentials made a partial report, which was adopted as a report of progress, and was subsequently completed, as follows:

Alumni Society of the Dental Department of the University of Pennsylvania—T. T. Hayward.

Baltimore College of Dental Surgery—R. B. Winder, Wm. B. Finney.

Chicago Dental Society—E. S. Talbot, R. H. Kimball, T. B. Wheeler, W. J. Martin, E. L. Guffin, E. L. Graves, B. L. Rhein, A. E. Baldwin, R. F. Ludwig, J. F. Austin, N. Nelson.

Connecticut Valley Dental Association—Chas. C. Barker.

Illinois State Dental Society—A. E. Brown, E. B. Call, J. Frank Marriner, John J. R. Patrick, H. J. Smith, C. A. Kitchen, J. S. Marshall, M. H. Patten, C. J. Tibbets, Geo. D. Sitherwood, J. G. Reid, P. J. Kester, E. Noyes, T. W. Brophy, W. W. Ormsbee, L. L. Davis, E. C. Stone, W. B. Smith, L. P. Haskell.

Iowa State University, Dental Department—L. C. Ingersoll.

Iowa State Dental Society—G. Knepper, M. H. Ross, A. R. Begun, A. Morsman, J. B. Monfort, S. A. Garber, A. B. Cutler, Geo. W. Fuller, G. W. Miller, W. P. Dickinson, J. T. Abbott, F. R. Ross, J. Hardman, E. E. Hughes, E. D. Brower, E. D. Nickson, E. L. Brooks, C. J. Peterson, L. K. Fullerton, J. S. Kulp.

Indiana State Dental Association—Seneca B. Brown, Robert Van Valzah.

Kansas City Dental College—C. B. Hewitt.

Kansas State Dental Association—W. M. Shirley, A. Doud, L. C. Wasson.

Kentucky State Dental Association—J. H. Baldwin, B. Oscar Doyle, M. L. S. Buckner.

Maryland and District of Columbia Dental Association—T. S. Waters.

Michigan State Dental Association—C. S. Case.

Missouri State Dental Association—A. J. Prosser, D. J. McMillen, C. W. Spalding.

Minneapolis Dental Society—J. H. Spaulding, J. H. Martindale, E. B. Dillingham, M. G. Jenison, T. E. Weeks.

Minnesota State Dental Association—Geo. V. I. Brown, F. A. Williamson, H. M. Reid, W. H. Crary, L. W. Lyon, S. T. Clements, A. T. Bigelow, C. M. Bailey, L. C. Davenport, Jas. M. Welch, W. A. Spaulding.

Nebraska State Dental Society—S. H. King.

New Jersey State Dental Society—C. A. Timme.

New Orleans Odontological Society—Joseph Bauer.

Northern Ohio Dental Association—W. H. Whitslar, L. P. Bethel.

Northwestern Dental Association—S. J. Hill.

Ohio State Dental Society—J. R. Bell, A. O. Howe.

Pennsylvania State Dental Society—Edwin T. Darby, J. W. Rhone.

Pittsburg Dental Association—S. S. Macfarlane.

St. Louis Dental Society—James B. Newby, A. H. Fuller.

Sixth District Dental Society of the State of New York—W. C. Stewart.

South Dakota Dental Society—S. J. Moore.

Susquehanna Dental Association—G. W. Klump.

Vanderbilt University, Dental Department—W. H. Morgan.
Washington City Dental Society—H. B. Noble.
Wisconsin State Dental Society—G. H. McCausey, C. C. Southwell, W. C. Wendel, Robt. Maercklein, C. P. Southwell, J. B. Williams, B. Douglass.

The Executive Committee reported the printed programme, which was adopted as the order of business for this session.

The Committee on Voluntary Essays reported, recommending that a paper by E. Parmly Brown, which was recommended to the Association at the last annual session, but which from want of time failed to be read then, be heard at some appropriate time during this session.

This report was adopted.

The special committee appointed to devise means for increasing the attendance on the meetings of this Association, reported verbally through the chairman, E. Parmly Brown, that "after mature deliberation they were unable to offer any practicable suggestions, and asked to be discharged."

The report was accepted and adopted, and the committee discharged.

On motion, the following committee was appointed on clinics: Drs. Smith, of Minneapolis, Gardiner, of Chicago, and Field, of Detroit.

The Publication Committee made the following report:

MINNEAPOLIS, August 4, 1885.

The Publication Committee would report that the arrangement with The S. S. White Dental Manufacturing Co., under which the Transactions have been published for some years, was renewed this year, and the work has been done without cost to the Association.

Its quality speaks for itself, and needs no further praise; but the thanks of the committee are again due to Mr. Hise, without whose careful assistance their labors would have been greatly enhanced, and the Transactions less creditable in every way.

The committee have also had printed five hundred copies of the Constitution, as revised to date, one of which was mailed with each copy of Transactions sent to those members entitled to receive them; as also to the various libraries, universities, journals, and honorary members. They were mailed March 23.

Your committee have also, at considerable trouble, though at small expense, compiled, and had bound, the business minutes of the Association from its origin up to date. They deemed it important that there should be such minutes in ac-

cessible form, and as there had never been any written minutes preserved, the only way to secure this end was that adopted by the committee. Where there were plenty of copies on hand, it was only necessary to cut out the minutes for binding; but there being no extra copies on hand of the issues of several years, it became necessary to have manuscript copies made for those years, as also manuscript indices for those and several other years.

These have all been bound in two compact volumes, which can easily be carried to the place of meeting; thus rendering it possible, when necessary, to refer to any transaction during the entire existence of the Association.

There are in the hands of the committee about fifty copies of Transactions for 1884, and about one hundred copies of the Constitution.

RECEIPTS AND EXPENDITURES.

Received from Treasurer		$75 00
Expended for expressage, paper, and copying	$15 35	
Printing notices and labels	5 50	
Copying minutes for binding	6 00	
Binding	5 00	
The S. S. White Dental Mfg. Co.'s bill, mailing and Constitution..	33 91	
Postage and incidentals	18 90	
		84 66
Balance due the Committee		$9 66

All of which is respectfully submitted.

GEO. H. CUSHING, *Chairman.*

Approved.

A. M. DUDLEY,
A. O. HUNT, } *Auditing Committee.*

On motion of Dr. H. A. Smith, the Publication Committee was instructed to have the Transactions for this year bound in more substantial manner than heretofore.

On motion of Dr. Sitherwood, so much of the report of the Publication Committee as had not been referred to the Auditing Committee was accepted and adopted.

On motion of Dr. Taft, the following committee was appointed to draft a memorial expressive of the sense of this Association on the death of Drs. J. G. Ambler, of New York, and Isaiah Forbes, of St. Louis: Drs. J. Taft, C. W. Spalding, and W. H. Atkinson.

The Committee on Credentials made a further supplementary report, which was adopted.

The Sections were then called, and the new members connected themselves as follows:

SECTION I. T. S. Waters, J. H. Baldwin, L. C. Wasson, A. Doud, T. A. Wadsworth.

SECTION II. M. H. Ross.

SECTION III. C. W. Spalding, W. O. Kulp, Geo. D. Sitherwood.

SECTION IV. C. S. Case, A. Morsman, B. L. Rhein, J. B. Monfort, H. A. Knight, S. H. King, E. L. Graves, T. T. Hayward, C. J. Tibbets, W. G. Martin, L. C. Davenport, J. S. Kulp, W. W. Ormsbee, Robt. Van Valzah, S. S. Macfarlane, S. J. Hill, Chas. C. Southwell, R. F. Ludwig, E. Noyes, Geo. R. Thomas.

SECTION V. L. L. Davis.

SECTION VI. E. L. Guffin, R. H. Kimball, C. M. Bailey, G. W. Miller, J. M. Welch, W. M. Shirley, J. S. Marshall, J. H. Martindale, W. H. Whitslar, L. P. Bethel, A. E. Baldwin, J. H. Spaulding.

SECTION VII. A. H. Thompson, J. J. R. Patrick.

The chairmen of Sections then announced the time and place of meeting of their various Sections during the afternoon.

Adjourned at 1 P.M. to meet at 8 P.M.

FIRST DAY—EVENING SESSION.

The Association met at 8 P. M., the President, Dr. Crouse, in the chair.

The minutes of the morning session were read and approved.

Under the head of miscellaneous business,

The Local Committee of Arrangements reported that the Minneapolis Dental Society proposed to entertain the Association by a trip to Lake Minnetonka, starting at 2 o'clock on Friday. The invitation was accepted.

The Committee on Voluntary Essays made the following report, which was accepted and adopted:

Your committee on Voluntary Essays would respectfully report that they have had placed in their hands three essays, of which they have made the following disposition:

Communication on "Pyorrhea Alveolaris," by W. H. Atkinson, referred to Section VI, with the recommendation that it be read.

Communication on "The Painless Operation," by J. A. Robinson, referred to Section IV, with the recommendation that it be read.

Communication on "Alveolo-Dental Membrane: Unity or Duality—Which?" by L. C. Ingersoll, referred to Section V, with recommendation that it be read.

[Signed by the Committee.]

C. N. PEIRCE, Chairman.

The Treasurer submitted his report, which was referred to the Auditing Committee, as follows:

MINNEAPOLIS, MINN., August 4, 1885.

AMERICAN DENTAL ASSOCIATION IN ACCOUNT WITH GEO. W. KEELY, TREASURER.

By balance on hand August 8, 1884		$1,823.95
" dues received since last meeting		400.00
		$2,223.95
PAID OUT.		
On order of Dr. W. R. Clifton	$200.00	
Chairman Publication Committee	75.00	
		$275.00
By balance on hand August 4, 1885		$1,948.95

Respectfully submitted.

GEORGE W. KEELY, *Treasurer.*

August 4, 1885, Minneapolis, Minn. Audited and approved.

A. M. DUDLEY,
A. O. HUNT, } *Auditing Committee.*

The Committee on Credentials made a further supplemental report, which was adopted.

The President made brief remarks, urging that hereafter the Sections should do more of their work before coming to the Association, and suggesting the expenditure of money, under the supervision of a committee appointed for that purpose, to promote original experiment and investigation.

Section VII being called, the report was read by Dr. A. H. Thompson, of Topeka, Kansas, as follows:

Section VII. Physiology and Etiology, H. A. Smith, Chairman.—The Section would submit to the Association a paper by Dr. W. C. Barrett, of Buffalo, upon the "Earthy Phosphates," and recommend its consideration.

On motion the Section decided to recommend that the Association make an appropriation of two hundred dollars for the prosecution of original investigations, to be expended, at the discretion of this Section, in the line of its legitimate work.

A. H. THOMPSON, Secretary *pro tem.*

The paper on the "Earthy Phosphates," by W. C. Barrett, was then read.

The subject was discussed by Drs. Spalding, Peirce, Atkinson, Abbott, Ingersoll, Sitherwood, King, Barrett, and Friedrichs.

On motion, adjourned till 9 A. M. to-morrow.

SECOND DAY—MORNING SESSION.

The Association was called to order by the President, Dr. Crouse, at 9.30 A.M.

The minutes of the evening session were read and approved.

Under the head of miscellaneous business, on motion of Dr. Peirce, a committee of three was appointed to take into consideration the advisability of acting on the suggestions made yesterday by the President regarding the appropriation of money to promote original investigation, as follows: C. N. Peirce, Philadelphia; A. H. Thompson, Topeka; E. D. Swain, Chicago.

The Committee on Credentials made a further supplemental report, which was adopted.

The subject of Dr. Barrett's paper was further discussed by Drs. Morgan, Patrick, Thompson, Spalding, Darby, and Atkinson.

On motion, the subject was passed.

Section I was called, but was not ready.

Section II was called; it also was not ready.

Section III being called, a paper on Nomenclature and Terminology was read by Dr. W. H. Atkinson; this was followed by one on the same subject by Dr. W. O. Kulp.

Discussed by Drs. Spalding, Thompson, Kulp, Taft, Morrison, Morgan, Atkinson, Friedrichs, Sitherwood, and Allport.

On motion, the Section was passed.

Section IV being called, Dr. Darby, the chairman pro tem., read the report.

Dr. Barrett then read a paper on "The Painless Operation," by J. A. Robinson.

Discussion on "Bridge-work" was then opened by Dr. E. Parmly Brown; on "Herbst's Method," by Dr. M. L. Rhein; on "Perry's Separators," by Dr. E. T. Darby; on "New Method of Engrafting Half-Bicuspid Porcelain Crowns," by Dr. H. B. Noble.

Dr. Southwell introduced and explained an appliance for directing the exhalations from the patient's nose away from the operator.

Dr. A. E. Matteson presented, with explanations, a new dental splint.

The Committee on Clinics made the following announcement:

Clinics will be given in this room, at 2 P. M. to-day, by Drs. T. T. Moore, of South Carolina; E. Parmly Brown, of New York; E. Noyes, of Chicago; St. John, of Minneapolis; and Dr. Harlan will treat cases of pyorrhea, Dr. Matteson will adjust a gold crown, Dr. Patrick and Dr. Weeks the same, and Dr. Timme will demonstrate Herbst's method.

On motion, Wednesday evening was set apart to hear Section V report.

One o'clock, the hour for the organization of Sections, having arrived, this business was proceeded with, resulting as follows:

SECTION I. Prosthetic Dentistry, Metallurgy, and Chemistry.—C. S. Stockton, chairman; W. B. Ames, secretary; H. H. Keith, J. A. Swasey, L. P. Haskell, Geo. V. I. Brown, W. A. Spaulding, C. S. Case, R. G. Richter, W. B. Smith, C. J. Peterson, C. H. Harroun, N. Nelson, Alonzo Boice, Wm. H. Trueman, C. W. F. Holbrook, F. A. Williamson, P. J. Kester, A. W. Freeman, E. H. Allen, Thos. C. Leiter, M. L. Chaim, C. F. Rich, S. A. Freeman, J. Adams Bishop, J. H. Baldwin, W. R. Clifton, James Cleland, S. T. Clements, Aaron Colton, Henry Cowie, S. W. Dennis, Chas. E. Dunn, C. W. Clement, J. H. Devore, Wm. Dutch, W. H. Dorrance, J. S. Kulp, H. M. Reid, N. W. Kingsley, Chas. F. Booth, F. C. Barlow.

SECTION II. Dental Education.—A. O. Hunt, chairman; T. W. Brophy, secretary; C. N. Peirce, J. N. Crouse, R. B. Winder, W. H. Morgan, G. W. Klump, A. E. Baldwin, E. P. Keech, C. C. Chittenden, Chas. D. Cook, S. H. Guilford, Geo. W. Fuller, Chas. H. Osgood, H. H. Jackson, Henry W. Morgan, C. A. Wingerter, R. Finley Hunt, J. L. Hill.

SECTION III. Dental Literature and Nomenclature.—Geo. D. Sitherwood, chairman; W. O. Kulp, secretary; W. H. Atkinson, J. Taft, E. S. Holmes, M. V. Toledo, E. A. Bogue, C. Bullock, Ira Brown, C. A. Kitchen, D. E. Kelley, Samuel E. Knowles, Joseph Lathrop, R. F. Ludwig, F. H. Rehwinkel, C. P. Southwell, E. S. Talbot, Martin Viet, J. Barker Vosburgh, F. A. Levy, Chas. Merritt, C. W. Meloney, Chas. A. Meeker.

SECTION IV. Operative Dentistry.—E. T. Darby, chairman; Geo. R. Thomas, secretary; A. T. Smith, A. E. Matteson, E. Honsinger, C. J. Tibbets, A. Morsman, E. Parmly Brown, J. H. Smith, R. H. Kimball, B. L. Rhein, T. S. Waters, J. W. Rhone, T. T. Hayward, L. W. Lyon, Geo. L. Field, C. A. Timme, B. G. Maercklein, W. P. Dickinson, J. M. Welch, E. Noyes, W. W. Ormsbee, Geo. W. Keely, H. J. McKellops, S. J. Hill, Chas. I. Keely, Chas. C. Southwell, B. Douglass, T. E. Weeks, J. B. Monfort, W. C. Wendell, A. H. Fuller, J. B. Newby,

T. B. Wheeler, Wm. J. Martin, W. C. Dyer, John A. Watling, J. R. Bell, F. R. Ross, W. H. Crary, A. J. Prosser, S. G. Stevens, E. P. Hawes, J. C. Walton, W. C. Starbuck, Eugene H. Smith, W. E. Page, A. N. Priest, E. D. Brower, L. C. Davenport, M. L. S. Buckner, Thomas Fillebrown, Jas. McManus, G. C. Daboll, Robert F. Horne, S. J. Moore, G. W. McElhaney, E. B. Call, J. T. Abbott, Chas. C. Barker, G. Knepper, J. Frank Marriner, J. A. Robinson, Robert Van Valzah, J. Hardman, W. N. Morrison, E. D. Swain, M. L. Rhein, A. R. Begun, Robert Maercklein, S. D. Hodge, Henry A. Knight, W. H. Fundenberg, W. H. Colgrove, J. N. Farrar, E. L. Graves, E. B. Dillingham, H. B. Noble, G. W. Hoysradt, S. G. Perry, D. J. McMillen, B. Oscar Doyle, E. C. Wadsworth, S. C. G. Watkins, V. H. Jackson, E. C. Moore, L. K. Fullerton, L. D. Shepard, M. F. Finley, A. H. Brockway, C. B. Hewitt, Dwight M. Clapp, Seneca B. Brown, C. R. Butler, W. H. Baird, Joseph Bauer, A. E. Brown, E. S. Gaylord, S. B. Palmer, W. B. Finney, C. A. Kingsbury.

Section V. Anatomy, Histology, and Microscopy.—Frank Abbott, chairman; L. L. Davis, secretary; T. L. Gilmer, Thomas T. Moore, E. L. Brooks, C. F. W. Bödecker, A. L. Northrop, Samuel A. White, L. C. Wasson, I. Williams, J. G. W. Werner, T. S. Hacker, F. Y. Clark, David Gibbons, J. L. Williams.

Section VI. Pathology, Therapeutics, Materia Medica, and Surgery.—A. W. Harlan, chairman; A. M. Dudley, secretary; T. A. Wadsworth, W. W. Walker, M. W. Foster, G. H. McCausey, J. D. Patterson, J. H. Martindale, F. H. Gardiner, J. S. Marshall, I. P. Wilson, W. H. Whitslar, L. P. Bethel, W. C. Stewart, W. W. Allport, J. H. Spaulding, Geo. J. Friedrichs, C. P. Pruyne, A. O. Howe, E. E. Hughes, M. G. Jenison, E. L. Guffin, J. Hooper, S. H. King, W. M. Shirley, E. D. Nickson, Geo. W. Miller, C. A. Brackett, C. M. Bailey, L. C. Ingersoll, Geo. F. Waters, J. W. Palmer, C. S. Beck, J. G. Reid, A. T. Bigelow, H. J. Smith, J. F. Austin, C. R. Jefferis, F. M. Odell, Wilbur F. Litch, William Carr.

Section VII. Physiology and Etiology.—H. A. Smith, chairman; A. H. Thompson, secretary; W. C. Barrett, J. W. Wassall, W. P. Horton, J. J. R. Patrick, C. W. Spalding, W. S. How, J. B. Williams, A. Doud, Denton E. Peterson, A. F. Emminger, F. A. Hunter.

At the conclusion of this business the Association adjourned to meet at 8 p. m.

SECOND DAY—EVENING SESSION.

The Association met at 8 p. m., the President, Dr. Crouse, in the chair.

The minutes of the morning session were read and approved.

Under the head of miscellaneous business, upon motion, the Treasurer was instructed to pay all properly authenticated bills.

The committee on voluntary essays reported, advising that a paper by Dr. Taft, entitled "Dental Association as an Element of Progress," be read if there be time.

The special order for the evening being the presentation of Dr. Abbott's paper, with illustrations, in Section V, Dr. Abbott, after presenting the report of the Section, proceeded to read the same. It was discussed by Drs. Peirce, Atkinson, Thompson, Abbott, Brophy, and Keith.

After which Dr. Ingersoll read his paper, entitled "The Alveolo-Dental Membrane: Unity or Duality—Which?" at the conclusion of which the Association adjourned to meet at 9 A. M. to-morrow.

THIRD DAY—MORNING SESSION.

The Association met at 9 A. M., the President, Dr. Crouse, in the chair.

The minutes of last evening's session were read and approved.

Miscellaneous business being in order, the Secretary read a communication from Dr. Geo. A. Mills, which had been mislaid at last year's session, tendering his resignation, which by vote was accepted.

The committee appointed to consider the advisability of appropriating money to Sections for purposes of original investigation offered the following resolution, which was adopted:

Resolved, That the committee now existing on prize essays be and is hereby discharged.

They further submitted the following report:

Your committee appointed to consider the advisability of appropriating money to the several Sections to be expended in the prosecution of original investigation, would respectfully report that it is the custom of various learned and scientific societies and institutions, both in this country and in Europe, to endow research in various realms in natural and physical science for the purpose of defraying the expenses of investigations, as well as supporting specialists and investigators who devote their time and talent to this work.

In Germany this is under government patronage, and all the great universities, as well as many minor schools of learning, support museums and laboratories, where chief specialists, with corps of capable assistants, are set apart and consecrated to the work of original investigation, pure and simple. The results we have

seen in the wonderful discoveries the Germans have made, and the stores of knowledge packed away in the ponderous publications which they issue.

In France and England, the endowment of research is more particularly under the independent control of the many learned societies and colleges in these countries. Museums and laboratories with corps of workers abound. Much is also accomplished by individual investigators by means of the assistance furnished them by learned societies. Thus, the British Science Association appropriates money every year in sums of from five to two hundred pounds to be expended for particular investigations, which are specially named. Many other societies do the same. These results are published in their transactions, and the discoveries made become the foundation of inventions which benefit mankind.

In view of the fact that this Association has funds on hand which should be employed for such purpose; that it is a scientific organization depending upon original research for all the progress it is to make; that its members have neither the time nor the means to conduct investigations which will contribute to that progress, except in a meagre and incomplete manner; and that the prestige, dignity, and usefulness of this Association are being compromised by the lack of originality in its papers and reports: your committee would respectfully recommend that appropriations be made for the prosecution of original investigations, to be conducted under the auspices of the various Sections, for the benefit of the Association and of the profession at large.

Money can be used by the Sections in the purchase of instruments, materials, and books; in the employment of experts and workers, either in or out of the profession, such as chemists, metallurgists, microscopists, physiologists, artists, colaborators, copyists, etc.; as well as for the expenses of printing, engraving, traveling, etc. For these and other matters the work that money can be made to do is almost limitless. The committee would therefore, to inaugurate this experiment, recommend the adoption of the following resolution:

Resolved, That the sum of one hundred dollars, or so much thereof as may be required, shall be appropriated to each of the following Sections, Nos. V, VI, and VII, to be expended at the discretion of the Sections in original investigations, the results to be reported to the next annual meeting of this Association.

C. N. Peirce, *Chairman.*
A. H. Thompson.
E. D. Swain.
} *Committee.*

The report was received.

It was moved to adopt the resolution proposed in the report.

Dr. H. A. Smith moved to amend by making the sum appropriated to each Section two hundred dollars.

This was discussed by Drs. Spalding, Horton, Smith and Peirce. The amendment was carried.

The resolution as amended was then adopted.

The regular order was now taken up, and Section IV was called.

Dr. W. O. Kulp introduced the subject of Artificial Crowns, describing a new method.

Dr. Peirce moved that speakers on Operative Dentistry be limited to eight minutes. Carried.

The discussion on Operative Dentistry was then participated in by Drs. E. Parmly Brown, W. O. Kulp, Stockton, Patterson, Daboll, W. A. Spaulding, Barrett, M. L. Rhein, Ingersoll, Atkinson, Darby, Allport, Thomas, McKellops, Abbott, Morgan, Patrick, Dyer, Ames, Taft, Brophy, and Horton.

The regular order was suspended to attend to miscellaneous business.

A communication from the Woman's Christian Temperance Union was read, asking the Association to pass certain resolutions.

On motion, the communication was received.

A motion was offered to adopt the resolutions.

Dr Spalding moved, and Dr. Barrett seconded the same, to lay the resolutions on the table, *not* because the Association did not sympathize with the objects of the resolutions, but because the consideration of such matters was entirely foreign to the purposes of this organization.

The resolutions were, upon vote, laid on the table.

On motion, the subject of Operative Dentistry was passed.

After some explanations regarding the proposed excursion to Yellowstone Park, the Association adjourned till 3 P.M.

THIRD DAY—AFTERNOON SESSION.

The Association met at 3 P.M., President Crouse in the chair.

The minutes of the morning session were read and approved.

Under the head of miscellaneous business, the Committee on Credentials made an additional report, which was adopted.

The Executive Committee reported that they had audited the Treasurer's and the Publication Committee's reports, and found both correct.

The report was adopted.

By unanimous consent, the Constitution was amended by striking out the word "and" in paragraph 6 of section I of Art VI, and adding the words "and Surgery" making it read Pathology, Therapeutics, Materia Medica, and Surgery.

The regular order being reached, Section V was re-called.

On motion of Dr. Abbott, this Section was passed, and Section VI being called, the chairman, Dr. Harlan, reported that there were three papers to be presented,—one by the the chairman, one by Dr. Patterson, of Kansas City, on the "Catarrhal Nature of Pyorrhea Alveolaris;" and one by Dr. Atkinson, on "Pyorrhea Alveolaris and Sponge-Grafting."

Dr. Harlan then read his paper, and was followed by Dr. Patterson, who in turn was followed by Dr. Atkinson.

Dr. Abbott then showed and explained an instrument for applying medicaments.

The subjects were then discussed by Drs. Abbott, Marshall, Atkinson, Davis, of Chicago, Taft, Thompson, of Topeka, King, of Lincoln, Neb., Ingersoll, and Friedrichs.

On motion, adjourned to 8 P.M.

THIRD DAY—EVENING SESSION.

The Association met at 8.30 P.M., the President, Dr. Crouse, in the chair.

The minutes of the afternoon session were read and approved.

Under the head of miscellaneous business, a letter from Dr. Clifton, of Waco, Texas, was read by the Treasurer, Dr. Keely, expressing his gratitude for the kindness of the Association at Saratoga, and their sympathy expressed since that time.

Dr. Dudley moved that the Treasurer be authorized to extend to Dr. Clifton the hearty congratulations of the Association upon the restoration to health of his son, who was so severely injured at the time of our Saratoga meeting, and the thanks of the Association for his kind expressions towards this body; and that he be instructed that, in drawing upon Dr. Clifton for the amount of his note, no interest upon the same shall be computed. Carried.

The Committee on Credentials made a further report, which was adopted.

The regular order was now resumed, and the discussion of subjects under Section VI was announced as in order.

On motion, the subject was passed.

Section I being called, the report, written by W. H. Trueman, of Philadelphia, was read by Dr. Stockton.

This was followed by a statement from Dr. Haskell, as to "What to do, and How to do it," and by Dr. Ames on "Methods of Sustaining Artificial Dentures."

Discussed by Drs. Morgan, Horton, Atkinson, Haskell, Spalding, Brophy, and Barrett.

On motion, the subject was passed.

On motion, adjourned to meet at 9 A.M. to-morrow.

FOURTH DAY—MORNING SESSION.

The Association was called to order by the President, Dr. Crouse, at 9.30 A.M.

The minutes of last evening's session were read and approved.

Under the head of miscellaneous business, the Committee on Credentials made their final report, which was accepted and adopted.

The report of the committee as a whole was then adopted.

Dr. Dudley moved that a committee of seven be appointed to consider the feasibility of this Association's calling an International Dental Congress, to meet in conjunction with this Association in 1887. Said committee to be instructed, if they report favorably, to present some plan of organization of said congress; the committee to report at the next annual session of this Association. Carried.

The Chair appointed as that committee, Drs. A. M. Dudley, of Salem, Mass.; C. N. Peirce, of Philadelphia, Pa.; M. W. Foster, of Baltimore, Md.; Frank Abbott, of New York City; T. W. Brophy, of Chicago, Ill.; A. H. Thompson, of Topeka, Kan.; and Joseph Bauer, of New Orleans, La.

On motion of Dr. Dudley, the Committee on Memorials was instructed to prepare resolutions on the death of General Grant.

The following announcement was made by Section VII:

This Section would report their decision to investigate the following subjects during the coming year and respectfully request the cooperation of all members of the Association in their work:

First. Investigation of the normal and abnormal qualities of the oral fluid.
Second. The tongue in health and disease.
Third. Personal hygiene for the dentist.
Fourth. Continuation of the study of the etiology of dental caries.

On motion of Dr. Harlan, the thanks of the Association were tendered to the railroads and steamboat lines, to the hotels, to the press of Minneapolis and St. Paul, and particularly to the Local Committee of Arrangements, for their various courtesies.

Also, a special vote of thanks to Parke, Davis & Co., of Detroit, for their contribution of the elegant programmes furnished for this session.

On motion of Dr. Dudley, the thanks of the Association were offered to the Minneapolis Dental Society and to the dentists and citizens of Minnesota for the courtesies extended to this body in the form of the excursion to Lake Minnetonka, as well as for the personal attentions shown to individual members.

Dr. E. Parmly Brown then read his paper on "Dentistry, its Past, its Encouraging Present, and Brilliant Future."

Dr. Morgan made a few remarks on the paper.

The regular order now being the selection of place of next meeting, a motion was made that the selection be left to the Executive Committee, to be announced through the journals when their decision should be reached.

Unanimously carried.

The election of officers was then proceeded with, resulting as follows:

President—W. C. Barrett, of Buffalo, N. Y.
First Vice-President—L. C. Ingersoll, of Keokuk, Iowa.
Second Vice-President—A. T. Smith, of Minneapolis, Minn.
Recording Secretary—Geo. H. Cushing, of Chicago, Ill.
Corresponding Secretary—A. W. Harlan, of Chicago, Ill.
Treasurer—Geo. W. Keely, of Oxford, Ohio.
Executive Committee—J. N. Crouse, A. M. Dudley, and A. H. Thompson.

The following resolution was adopted:

Resolved, That the rooms provided for this, the twenty-fifth annual meeting of the American Dental Association, said rooms belonging to the Curtiss Commercial College, and furnished through the kindness of C. C. Curtiss, are the finest in their appointments of any rooms used by this Association in its annual meetings.

On motion of Dr. Ingersoll, it was

Resolved, That the thanks of the Association be tendered to Dr. J. N. Crouse for the very efficient manner in which, as President, he has conducted the affairs of the Association during the year, and especially in all matters relating to this very successful meeting; and also to the First Division of the Executive Committee.

On motion of Dr. A. H. Thompson, of Topeka, Kansas, the following was unanimously adopted:

Resolved, As an expression of the appreciation of the valuable services of Dr. J. N. Crouse as presiding officer of this Association during the meeting just closed, as well as of his many excellent professional and personal qualities, that he be presented with the gavel which he has so effectively wielded during this most successful and enjoyable meeting; and that the same be appropriately mounted and inscribed.

The Committee on Credentials made a second final report, which was adopted, and again the committee's report as a whole was adopted.

Dr. Morrison moved to appropriate five dollars to the elevator boy. It was so ordered.

The Committee on Memorials made their report, which will be found in the memorial pages.

The following was adopted:

Resolved, That a paper presented to the Committee on Voluntary Essays and by them considered and returned to the writer with notification that the said paper is not accepted, cannot afterwards be read before the Association unless it is made the special order by resolution adopted.

Section II being called, the report of the Section was read by A. O. Hunt, its chairman, and was adopted.

On motion, the installation of the newly-elected officers was proceeded with.

Dr. Barrett, the newly-elected President, being introduced, said:

I should be something more or less than human if I did not appreciate the high compliment that has been paid me. I love dentists better than any other class of men on earth. No other body of men could have proffered me an honor that I should appreciate so tenderly as that which comes from my brother practitioners. Such a compliment is a distinction that any man should be proud of if it came unsolicited, and I challenge any member of this Association to say that I have even intimated a desire to be honored by your votes.

I am well aware that certain of those, who I trust may at some time know me better, have believed that I was a chronic seeker after office, yet I solemnly assert that never but once was I knowingly voted for or made the candidate of any one for any office within the gift of my brother dentists. Coming then thus unsolicited, I declare to you that you have conferred upon me a distinction that makes me respect myself more than formerly. There must be some good quality in the man whom such a body as this chooses for its presiding officer. I rejoice that I have your confidence to this degree, and I will labor faithfully to be worthy of it.

On motion, the President was authorized by unanimous vote to appoint the Local Committee of Arrangements when the place of next meeting shall have been announced by the Executive Committee.

The President appointed on the Publication Committee Drs. A. W. Harlan and E. T. Darby.

The following notices were given of proposed amendments to the Constitution:

By Dr. T. T. Moore.

To amend Article IV of the Constitution, by striking out the word "first," in the third line, and inserting in lieu thereof the word "fourth," making the article read fourth Tuesday instead of first Tuesday in August.

By Dr. C. N. Peirce.

To amend Article IV, page 9, by striking out these words, "The place of meeting shall be determined each year by vote of the Association," and inserting in their place the following:

"The place of meeting shall be determined each year by the Executive Committee, and notice of the selection made announced to the members of the Association through the dental journals not later than the first of March preceding the annual meeting."

By Dr. A. H. Thompson.

To amend section 2 of Article VI to read as follows, viz.:

"Section 2. It shall be the duty of each permanent member to identify himself with one or more of the above named Sections, and he shall inform the Recording Secretary of his choice at the time of joining the Association. At the close of the morning session of the second day of the annual meeting, the roll of members in good standing shall be called for the annual reorganization of the Sections, and each member shall answer to his name by announcing his choice of Sections. The Sections may, by permission of the Association, hold separate meetings for the reading of papers and discussions, and report the same in abstract to the full meeting of the Association."

The minutes were then read and approved, and on motion the Association adjourned to meet the first Tuesday in August, 1886, at such place as the Executive Committee shall hereafter designate.

GEORGE H. CUSHING, *Secretary.*

IN MEMORIAM.

DR. ISAIAH FORBES.

WHEREAS, This Association having received intelligence of the death of Dr. Isaiah Forbes, of St. Louis, Mo., who has long been identified with the interests of the dental profession in this country, would, as an expression of the high esteem in which the deceased was held, adopt the following:

Resolved, That in his death the profession of dentistry has lost a careful, conscientious, and ever faithful member, one who was justly entitled to the respect and regard of his associates throughout his long professional career. For a number of years he creditably filled a chair in the Faculty of the Missouri Dental College, and was at all times active and earnest in all laudable efforts for the promotion of the higher interests of the profession of which he was a member.

Resolved, That a copy of this preamble and resolution be properly engrossed and sent to the family of the deceased, and also that copies be sent to the dental journals for publication.

DR. J. G. AMBLER.

WHEREAS, Information has been received by this Association of the death of Dr. J. G. Ambler of New York, who has long been an active member of this body, and who for more than forty years occupied a prominent position in the dental profession, and was ever ready to do what he could for its promotion and elevation; therefore

Resolved, That in his death the profession has sustained a loss which is sincerely deplored and this Association a valuable member who was active for the promotion of its best interests and prosperity; and that we regard his social and professional qualities as deserving high esteem and his example as worthy of imitation.

Resolved, That a copy of this preamble and resolution be sent in proper form to the family of the deceased, and also to the dental journals for publication.

GENERAL U. S. GRANT.

WHILE we humbly bow to the inevitable decree of the Disposer of all things in the removal of General Grant, this Association would record its deep sense of loss, its high appreciation of his public services, and its sincere sympathy with his family and friends and with our countrymen at large.

Resolved, That a copy be sent to the journals for publication.

SECTION VII.

Physiology and Etiology.

The Earthy Phosphates.

Paper by W. C. BARRETT, of the Section.

The administration of the earthy phosphates to pregnant women and to young children has been a favorite prophylactic method of treatment with many intelligent dentists. The theory upon which this system was founded is that decayed or defective teeth owe their condition to trophic disturbances, and that it is but necessary to supply the missing elements in order to produce perfect dentures.

The theory is a very plausible one, and it gave credulous practitioners excellent opportunity to enlarge upon the wonderful process of gestation, and the marvelously interesting double function of the expectant mother, whose digestive apparatus must furnish not only pabulum to sustain her own physical being during a trying period, but substance to the fetal man or woman which she carried beneath her heart. If her own teeth decayed during the period because of the neglect that at such times is common, she was perhaps treated to long dissertations upon the imperative demands of the growing fruit of her uterus, which, not finding the needed elements in the blood with which she supplied it, was robbing her own osseous system to supply its wants. If her teeth were found to be soft, it was because their character had changed, and the lime-salts of their crystalline structure had been taken out to build up the young child. Corroborative evidence, when looked for with biased judgment, was not lacking, and dentists had many tales to relate of the most stupendous changes effected in the dental development of children through a judicious administration of the lacto-phosphate of lime to the mothers during pregnancy. The instances in which such results seemed apparent were cited, while those in which no

effect resulted were not included in the category, or were attributed to a want of faithfulness in taking the prescription. We believe that which we desire to believe, and there is no difficulty in finding apparent confirmatory evidence to sustain the most absurd of postulates when one sets out with a determination to do so.

There is probably no one who has followed the prescribing of the earthy phosphates for a supposed dystrophic condition who will not, if his memory be refreshed and his data perfect, call to recollection very many failures. If he shall have traced the after-history of children born of mothers who during pregnancy were subjected to the phosphatic treatment, he will probably find quite as many with defective teeth as in those who were born under other conditions. Earlier in my own professional history I experimented with the different preparations in numerous cases. One of the first of these was that of a lady pregnant with her second child, the first being in a deplorable dental state. The seeming results were amazing. Not only was her gestation more pleasant and easy than the former one, but the dentition of her infant was almost entirely without the usual febrile disturbances, and the child's teeth, up to the time when I lost sight of him through the removal of the parents, presented a remarkable contrast to those of his elder brother. This case would possibly have confirmed me in the use of the phosphates were it not that about the same time I had contrary experiences. In one notable case, that of a lady pregnant with her fifth child, I persuaded her to a thorough course of my then favorite remedy. All the other children had excellent teeth, their dentition being much above the average. There was no special reason why she should be subjected to prophylactic treatment, except that I fancied I saw disastrous effects impending to her own teeth, from what I presumed to be an abnormally soft condition, and because I was at that time pushing this investigation with strong hopes that I had hit upon a means by which a perfect dentition might be assured to every child. As time rolled on I beheld the direct antithesis of the first-cited case. The child had all manner of difficulty in getting its teeth, and when they were in place I saw, to my confusion, the only really bad denture in the family.

Of all the women whom I subjected to this treatment, there was not one in which the experience of the lady of the first instance was repeated. That case was, no doubt, an accidental one, and the results were due to something besides the lime treatment. Experience alone led me to entirely abandon the practice, and when sub-

sequently I made a more thorough study of the physiology of nutrition, I became confirmed in my skepticism concerning the utility of the feeding of phosphates to pregnant women, or even the indiscriminate recommendation of such foods as are particularly rich in earthy materials. The facts are against it.

A few years since it was common to hear denunciation of the use of fine flour, from which it was declared that the miller had eliminated all that was of use in the building up of the bony system. Elaborate papers have been read before this Association in which it was demonstrated to the satisfaction of the really thoughtful and honest essayist that the decay of teeth, which was supposed to be a modern disease, was due to the lack of phosphates in the fine flour that formed the chief article of subsistence, Since then computations have been made of the amount of bone-making material that is found in the finest of wheat flour, and of the amount that is needed by both mother and fetus during gestation, and it has been demonstrated that, should she live entirely upon this article of diet, there would still be an excess of the lime-salts. It is a fact that during pregnancy there is almost universally a continual elimination of these principles, which are easily traced in the excretions. Any pregnant woman who lives upon almost any diet that is sufficient to sustain life will, if the nutritive organs be in proper condition, find more than is necessary of these elements to keep the system in proper condition. It should be remembered that the nutritive changes in the bones and teeth are less than in the other tissues of the body, because they are more permanent in essential structure and character. Especially is this the case with the teeth, in which the trophic changes are very limited indeed. That such a dystrophy may exist as shall materially affect these organs, no one will probably deny ; but the process will of necessity be but a slow one, and the changes will not soon be manifest.

And now let me detail some of the physiological reasons why the giving of the earthy phosphates for nutritive purposes must be a mistaken treatment, and why, to my conception, it is based upon erroneous assimilative views.

All pabulum must originally be derived from the earth. That is the primal source of all nutritive material. But there is no order or class in the animal kingdom that can elaborate it. There is no animal organism that can derive nourishment directly from earthy matter. That function rests solely in the vegetable kingdom. Animals are not primal organizers. They cannot digest the inorganic.

They require organized structures for their food. The study of vegetable physiology shows that these alone have the ability to assimilate inorganic matter, and out of earthy material to organize tissue that shall serve as food for the higher orders. When matter has once been organized into vegetable products it may serve for the sustenance of animals.

Some of the animal kingdom subsist upon matter that is but one remove from the inorganic. To this class belong the Graminivora. Other animals require that their food shall have been twice organized; first from the earth into a vegetable form, and again by an animal into a higher form. To this class belong the Carnivora, which cannot digest or assimilate vegetable organisms until they shall have been reorganized into an animal.* Others are omnivorous, and their digestive apparatus will prepare nutritive matter that has been but once organized into vegetable life, or that has been again organized into animal existence. To this class belongs man. But neither he nor the Graminivora can make nutritive use of inorganic matter any more than can the Carnivora. It follows, then, that if inorganic matter be introduced into an animal organism it is entirely foreign, and must be eliminated in an unchanged condition. If it remains within the system, it is essentially and must ever be a foreign substance, an irritant, that, if not promptly rejected, will create internal disturbances of a more or less serious nature. All inorganic matter, then, is foreign to the animal system, and, so far as nutrition goes, it is not only entirely useless, but absolutely mischievous.

It is true that certain toothless classes, which are provided with a proventriculus, swallow inorganic crystalline bodies, but these answer only a mechanical purpose, in assisting to triturate the food, thus adventitiously serving in place of dental organs. The small stones in the gizzard of the fowl are foreign bodies, which play no part in assimilation.

Some of the proximate principles of animal bodies are made up mainly of inorganic material, but they never exist as simple substances, unless in the case of the iron of the blood, if that be a proximate principle. That exists only in a kind of solution, held there by the other constituents, and it is not assimilated directly. The calcium of the bones and teeth exists in combination with other sub-

* It is a rather singular fact that most of the animals that require their food twice organized are unfit for food themselves. Their flesh is rank, unpalatable, and innutritious. There are exceptions among fishes and birds, but of the mammalia the flesh-eaters are themselves uneatable.

stances, and it is never assimilated directly, but it is elaborated and the combination formed within the system. The carbonate of lime and the phosphate of magnesium are not taken up as such, but the carbon, the phosphorus, the calcium, and the oxygen are elaborated within the organism, and their chemical union is there completed when they are built into the tissues. The building of this animal house of ours cannot be brought about by feeding bricks and mortar. The raw material must be furnished in other compounds, which it is the province of the nutritive apparatus to disorganize, to separate into their constituent elements, and to re-combine into tissues. Every particle of tissue principle must be elaborated within the body, and built up, not from compounds, but from simple elements. If carbonate of lime be needed for the teeth, it is of no use to feed oyster-shells. The system will not take carbonate of lime, but it will elaborate the material from the calcium, carbon, and oxygen that it derives from food, and it will take its carbonate of lime in no other way. It is the same with the phosphates, and hence the inutility of giving any preparation of that material which cannot serve as pabulum. So complete and perfect is the nutritive process in the healthy organism, and so universally and admirably are the elements provided in all organic matter, that a perfect digestion will find in any material that is fit for food sufficient of the different ingredients to elaborate into pabulum for all the tissues. Were not this the case, it would be impossible for the different races to exist under all the varying conditions in which they must live. The dweller in the hyperborean regions of the far North, where vegetable life scarcely exists, must make a subsistence almost exclusively out of an animal diet. But his whole system is as well nourished as is that of the omnivorous dweller in the temperate regions. There are those who live upon an exclusively vegetable diet, and none of the tissues are starved. People have subsisted wholly upon fruits. Yet every organ was perfect, because of this universal diffusion of the elements of nutrition. The simple substances of which the body is composed are comparatively few, and are found everywhere. Were it otherwise,—were it the case that the organism is unable to elaborate its compounds from the elementary substances; were it the fact that carbonate of lime and fluoride of calcium and all the compounds must be supplied as they exist,—it can readily be seen that animals could not subsist upon a simple diet. It would be necessary to supply such foods as contain the exact compounds needed, and this, except under the most favorable conditions, would be impossible.

Hence but a very small proportion of the earth's surface would be habitable, and most orders of animals would become extinct through inability to obtain the exact compound needed for so complex a nutrition. The laws governing our existence are simple, if we would but study them intelligently. Animal life can subsist upon almost any kind of organic matter not absolutely poisonous, and yet be well nourished.

Inorganic matter does, however, play an important part in the human economy, but man is the only animal that makes any extended use of it. Many inorganics act as special irritants or excitants to definite organs. Their very presence in the system may induce certain structural or functional changes, and thus, in abnormal conditions, they may play an important part. When they are administered for any such purpose we call them remedies, and man is the only animal that employs them. Our medical pharmacopœia is largely made up of inorganic matter, to be given for the purpose of inducing certain changes corrective of others brought about by dystrophic conditions. If intestinal function ceases through the presence of innutritious or indigestible matter, an inorganic remedy may by its mere presence induce such violent peristaltic action as to eliminate the obstructive matter. Alterative effects follow the ingestion of some inorganic substances, but it should always be remembered that such matter is foreign to the organism, and is always extruded at the earliest opportunity. It takes no part in nutrition, and is never built up into the tissues. I believe it to be a general rule in physiology that inorganic matter introduced from without is always foreign to the system, and it is always eliminated as soon as possible.

It must follow, then, that the giving of the inorganic earthy phosphates for nutritive purposes is always a mistake. If they act at all it must be remedially, and if they are to be so used they should be intelligently prescribed, like any other agent, and only for their medicinal properties. I have no knowledge that they have any very decided medicinal virtues, and therefore I can see no excuse for dispensing such inert compounds.

DISCUSSION.

Dr. Spalding: I do not rise for the purpose of refuting in a general way the position taken by the essayist, but there are some points that I have not yet been able to reconcile in relation to that

subject, and I presume others have met with the same difficulty. I think it is very clear that, as a general rule, inorganic substances cannot be incorporated directly into animal tissue, but after those substances have been organized into vegetable tissue, and again into animal tissue, they can be, certainly, as medicine. There is one substance in very common use by men and by a large portion of the animal kingdom, that seems to me to constitute an exception, if there is an exception, to the rule, and that is chloride of sodium, or common salt. That salt is a mineral substance, every one must admit. That it is taken into the system regularly and generally by man and by many animals is also evident. We know, however, that common salt is eliminated from the system unaltered, but we do not know that ALL the common salt that is taken into the system is eliminated. We know that it appears in the excretions, but the quantity which appears, I believe, has never been determined to equal the quantity which has been taken into the system. It probably undergoes some decomposition. If it undergoes decomposition, why are not the elements of which it is composed, when they are set free, simple elements? Why are they not capable of being incorporated into the tissues just as well as other simple elements that are brought into the system in any other way? I do not attempt to assert that this is a positive exception to the rule, but I raise the question whether it is not. I would like to hear that question discussed. We know that there are many animals, especially in a state of nature, that seek for salt. It is well known that deer frequent the deer licks. The hunter takes advantage of that appetite of the wild animal. The question comes up, is that a perverted taste? Is that an appetite acquired by habit, or is it one that is implanted by nature? I think it is a natural appetite, an appetite for that which the system of the deer craves. Quite a number of our domestic animals will certainly become diseased and out of condition unless supplied with salt. The question is, what office does the salt perform? Does it become incorporated with the tissues of the body, or does it act only in a remedial sense?

DR. PEIRCE: While with much of the paper to which we have listened I fully agree, yet there are ideas embraced in it that seem to me to be antagonistic to the laws governing nutrition and organization. The writer expressed the thought that man was the only animal employing therapeutic agents,—remedial agents outside of his food. Any one who is familiar with the horse knows that frequently he will eat clay by the quantity, and he does it because it

serves a purpose in nutrition. There is some abnormal condition of the digestive system which demands the consumption of that kind of diet. The dog, which is truly a carnivorous animal, eats grass. Every one is familiar with the fact that both the dog and the cat almost daily eat their modicum of grass to keep their digestion in condition. As for the system not being competent to appropriate what he terms inorganic material, every one who is familiar with the poultry-yard knows that the very moment the chickens are deprived of the oyster-shell, or lime in some form, the eggs are laid without or with imperfect shells.

We are mystifying ourselves very much in speaking of inorganic and organic material. The straw which supports the head of wheat is indebted to the lime which it has taken up from the soil for its strength, and the lime is not the less inorganic because in that form. The herbivorous animals eat the vegetable matter and get the lime for the body, but it is lime the same, and as much inorganic as if they had taken it in their drink, as is frequently the case. Inorganic salts are constantly taken, either through the vegetable or animal kingdom. Every one who is familiar with raising the various cereals knows the very great importance of having the land supplied with lime at certain intervals. Without it we may have other fertilizing material in excess upon the soil, and yet the stalk, unsupplied with lime, falls to the ground for want of strength. It has lately become very common with our agriculturists to sow salt over the oats field. It was thought that oats could not be raised upon rich ground, but now a few bushels of salt to the acre spread over the ground give the oats a strong stalk, which will support a heavy head. It is in that way that our herbivorous animals usually get their needed amount of lime.

The few instances where excellent teeth were found following the administration of phosphates, or poor teeth where they had not been used, are not by any means conclusive, either for or against their utility. We can oftentimes benefit our patients by the proper administration of salts of lime, not that they are directly taken into the system and appropriated, but that they serve a purpose in aiding nutrition. They enable the food that has been eaten to be assimilated. We know the tendency oftentimes to fermentation, where the stomach has been overloaded, and that a little lime-water administered in such cases will place the stomach in a healthy or normal condition.

It struck me that the gentleman had the cart before the horse, in

assuming that the animal is made for a certain class of diet and the diet is essential to the animal. The diet, gentlemen, makes the animal. The food habit and nutrition are, in my estimation, the mother of organization. These it is which give us our teeth, both in regard to their structure and their form. Take any of the groups of animals, whether herbivorous or carnivorous. We can nourish them from food upon which they have not been accustomed to live, and through successive generations we can so modify their structure by a persistent change of diet that the structure finally becomes suited to the diet. It is the food habit that precedes and is the mother of tooth-organization. In looking over the various groups of animals, we find in every variety certain specialized tooth-forms, and in their peculiar adaptation to the diet we see how those tooth-forms are the result of the food habit. Take the carnivorous animal,—it does not matter whether it is aquatic, arborial, terrestrial, or fusorial, whether it lives on the earth, in the trees, or in the water,—the food habit has made the same structural arrangement of teeth. Our domestic dogs were originally carnivorous. We find in this class of the carnivora the teeth are of great variety. They vary in number and in shape, simply because of the change in the food habit. We take the polar bear: in him we find a true set of carnivorous teeth, while in the black bear of Kentucky we find a grinding molar which does not exist in the truly carnivorous animal. The point I wish to make is simply this, that the food habit is the mother of the organization, and unless function, which precedes and influences nutrition, can be kept in a normal condition, we cannot have a perfect organism. Let me explain. We have the human family to deal with in our practice. We find a large class of children who are supplied with fluid with their food. They eat a mouthful of food and wash it into the stomach. Wherever that course is continuously pursued we find the teeth soft and inclined to decay,—to break down or disintegrate. There is lime enough in the food eaten, but the teeth themselves are not stimulated by use. Function is delegated to the stomach, and the teeth, by losing their normal function, have deficiency of structure, loss of density, and a weak power of resistance: so we have failures in our efforts for the saving of the children's teeth. Loss of function is the cause of disintegration more than deficiency in diet. As the gentleman said, very properly, the diet to which we are subjected has lime enough in it. All it wants is the function to stimulate healthy nutrition, and we should have good teeth; and now by this loss of function through

successive generations we have almost universally this pathological condition called dental caries. As I said in the beginning, with much of the paper I fully agree, but I felt that the author had not recognized the importance of function as a prophylactic and organizing agent. With leisure to read the paper carefully and compare it with some authorities, it is probable that other points would be found open to criticism.

Dr. Atkinson: The last speaker gave me the cue to open the gates for the inflow of a concept of principles that are too much ignored. He said he wished to have the paper and some authorities by his side so that he could collate them. I wish him to first assume that he has the authority of deciding as to the righteousness of the conclusions that the "authorities" have set down and that are nominated in the paper. I want to congratulate my friend Dr. Barrett upon his growth. It is but a very short time since he was the man, *par excellence*, of rocky understanding, and of having this assimilation go on directly by the action which he has detailed so instructively to us to-night. It is a very easy thing when a man sets out to prove a certain postulate to catch all the testimony in its exposition that tends to establish his conclusions, while the others are let go and passed out, not coming into the decision of his mind as to where the real truth is. I have learned that the way to get over the difficulties is to understand them myself.

The first objection that I have to the classification is, into organic and inorganic. That is the doubled and twisted first lieutenant of his Satanic Majesty. They speak of two organic bodies, and call them both inorganic,—the chloride of sodium and what is nominated as water. Hydrogen and oxygen make water, and chlorine and sodium salt; and they use the term as if there was no other salt than the simple salt found in the sea. They said that articles might be good for medicine that were not good for food. We need to tear down all these false gods that we have been worshipping and understand the true foundation, the alphabetic postulates, to enable us to be sure that we are going right. So many examples have been presented to us in our observations where "one man's meat is another man's poison," that we must modify these views. Any substance that can act upon the human body at all may, according to its necessity, be food, poison, or remedy, and they act by reason of the awakening of latent energies in those substances, answering the demand roused by deficiencies in the organism, to supply a need, and that carries us beyond the plane of what is called scientific certitude,

and makes us deal with purely mental concepts, and afterwards to apply them in the mass way which has been done so lucidly to-night. Until we shall have attained the ability to comprehend something of how pabulum is produced, and what it is that changes a substance from a nutritious food to an innutritious substance, we may hammer at these questions until the crack of doom without being benefited. It is the demand of the system that renders substances either food, medicine, or poison. It is difficult to bless you with correct, serial, orderly arrangement of statement, when we have such a multiplicity of assumptions with but a few statements of facts to deal with. The principal difficulty is that we are looking after consequences while we attempt to investigate conditions that shall enable us to make up our minds as to what is the nature of the demand that we call hunger. Hunger resides in a body so small that it is difficult for people who have not investigated embryological and histological questions to comprehend it. Almost every one says he is hungry in the stomach. We are hungry, wherever the pabulum has been burnt up, throughout the entire organization. The satisfaction of hunger means the building up of the tissues of the body by supplying them with the substances that they have lost because of the operations of function.

One gentleman said that the salt passed out of the organism without being changed. He had better revise his animal chemistry. We might as well say the portion of the oxygen in the air that we breathe and is not appropriated in the organism, or has once been within the grasp of the lungs, passes out without being influenced. Ninty-six per cent. of it is as dead as a door-nail, and we only appropriate four per cent. What is that fine change that kills the oxygen that has once been within the grasp of the lungs? We had better be honest and say we do not know. When we say that, we shall be in a recipient condition, whereby we may catch the illumination of truth as it comes to us.

One gentleman said it was the food habit that formed the teeth; that the food habit is the mother of the tooth-form. All that is very scientific!! with exclamation points. They assume that matter does all things. They forget entirely that it was energy that arranged the matter, and that the energy had an order in it, and that it had the means of classification, without which energy we would have no classification. When we are determined to cancel all the false teaching that has brought us thus far, we shall be able to begin with something like a definite start, and that start is simply an as-

sumption, and the scientists, so called, the materialists especially, are the wildest in assumption of any set of investigators I have ever dealt with. Every assumption is to be made as a first basal statement, and then another opposite assumption, and then we will cancel them, and so go on and have our minor propositions brought together until there shall be two principles in opposition to each other which, when solved, reveal to our consciousness the truth. What is that assumption? It is this: Atoms are eternal entities, with motic and static aspects. That is the basis upon which we start, spiritists and materialists. But the materialistic physicists won't acknowledge that there is any power in the atom, that it can be awakened, and that atoms can be brought together by awakening certain other energies, so as to make the combinations that are satisfied in the building of the tissues and the entire organism. It is the awakening of the sleeping energies in these two "inorganic" [?] bodies, (the sodium and chlorine) that by being organized from their first postulates renders them capable of acting upon the body. They are atomic. As soon as they are married together by the incoming of this energy that awakens the affinity in them, they become a molecule, a body of two elements, and that is an organism, if there is such a thing, and that is true of every organization. You see how difficult it is to deal with such deep questions as are involved in the speeches that have been made to intelligences that are not thoroughly erudite in looking at things that are beyond the range of the natural vision, that are only revealed to our sight by the use of microscopes that enlarge simple bodies so as to bring them within the purview of our consciousness.

To show that there is a misapprehension about the care of pregnant women that is engaging the attention of medical men so earnestly, let me say that, as a rule, medical men attribute to the last medicine administered any effect that follows it, without noticing the action between, so that adventitious administration of that which is actually offensive and detrimental oftentimes gets the credit of being the immediate antecedent of the cure, or even the cure itself. How did that come about? It came about by a certain class of men saying that they knew all about this question, and formulating it, and then requiring the pupils that came to their colleges to simply memorize all the untruth and what little truth there was in it. These pupils after passing such courses went out and were called the medical profession at large, and I am pained to think that in the organization of this body such efforts have been

made to have that profession recognize us, which efforts fortunately have been broken by the angelic light that came to us from New Orleans by these old fogies rejecting this body.

Dr. Spalding: We take salt into the system, and it appears in the excretions. I want to know whether it has passed through the system unchanged, or whether it has been decomposed.

Dr. Atkinson: The only way we can decide this is to pursue the same method whereby we can prove that the oxygen is killed; by trying to see if that which has passed out will perform the same change in another body that we may apply it to as that which has not been so treated will do. Oxygen that has been breathed through the lungs has been secured and preserved, and when it has been attempted to pass it through the lungs again, it has been found to be nil; so salt has been proved, but not to the same extent.

Dr. Spalding: Then shall we report you as saying that salt does not appear in the excretions?

Dr. Atkinson: Do just as you please about that.

Dr. Abbott: For a number of years I went through something of the same experiments that Dr. Barrett has spoken of, with the idea of producing better teeth for children, but in no particular instance have I ever seen any very marked improvement. One case which I reported, I think, to this body, where I thought I had really produced a change for the better, and had struck upon an idea which would eventually result in a good set of teeth for every child born, gave me some encouragement, but to my astonishment I have not produced any marked results in any other case. Even the apparent results in that case may have no foundation, as I have, to all appearances, in the many other cases where I have tried, failed to get any benefit whatever. One experiment which seemed to favor the theory that this treatment is correct, consisted in breaking the legs of two rabbits, to one of which was administered the lacto-phosphate of lime, while it was withheld from the other. In the rabbit to which it was administered, it was found that the fracture healed much more readily than in the one where they had not administered it. From this experiment they gave out to the world that here was a remedy for all diseases which seemed dependent upon the lack of this one element, phosphate of lime. While this seemed to work very well in the case of the broken leg of the rabbit, it has, I think, proved unsuccessful in the hands of all who have tried it for the purpose of producing more perfectly developed teeth in children. I have not fully given up the idea, however, that we may get some benefit from

phosphate of lime if it is administered in a way to be more readily assimilated. As we administer it now, it does not assimilate, probably because it is not chemically properly prepared. Phosphate of lime proper, consists of one part of phosphorus and three of lime. We have so far failed in materially aiding to build the osseous structures by the administration of lime as such. I believe that every person with a good appetite takes in his food sufficient phosphate of lime for all and every purpose, and if digestion, secretion, and assimilation are properly performed, the results never fail to be satisfactory; but, unfortunately, during gestation ladies are often unable to take *and retain* food enough to nourish themselves and provide for the proper development of the child, so that some easily assimilable form of phosphate of lime seems desirable.

Dr. Peirce: My friend Dr. Atkinson made a happy point when he asked if I said that the *food habit* was the mother of tooth-forms. I want to make that point a little clearer, if possible. If you will go into our museums with a pair of dividers, as did Dr. John A. Ryder, and examine the mandibles or lower jaws of the animals therein, you will find that, by placing one arm of the divider upon the condyle, the free point of the other will describe the valleys of the molars. This will be true of a certain number of groups of animals, while in others the arm of the divider must be placed midway between the condyles, and again the point of the other arm will line out the valleys of the molars in like manner. This gives us the condyle and the intermediate point as the odontomorphic or tooth-shaping centers. In one case it is uniaxial, in the other biaxial, but in both it illustrates how the movement of the jaw has shaped the valleys and cusps of the teeth. It is that the food habit acted through the movements of the jaw, and by controlling those movements, controlled the shape of the teeth.

Dr. Ingersoll: I would like to ask Dr. Peirce if he said under the stimulus of the food habit both organs and functions were developed?

Dr. Peirce: I did say that necessity preceded function. The necessity for the function comes before the function. The necessity for the tissue and the function both precede organization. Another point I wanted to make was this, that in the absence of function we had the absence of nutrition, the same as if you should put your arm in a sling the muscles would dwindle for want of use. So by the delegation of function to another part nutrition follows the function. Nutrition goes where the function is, and it is by the absence of

function that we have this almost universal destruction of children's teeth.

Dr. Ingersoll: There are two or three questions which arise in in my mind in regard to this. The first question is whether the formation of the stomach is the result of the development of teeth, for without the necessity of solid food we should have no necessity for the stomach. Then I should like to ask Professor Peirce if the cud chewed by the bovine is the mother of the double stomach of the bovine species of animal. These questions have arisen in my mind, in connection with this subject, and I would like to have an answer.

Dr. Peirce: I admit that there is a great deal of obscurity in the matter of development, but I still adhere to the statement that the function is the mother of organization. The necessity or the habit of cud-chewing developed the double stomach. You know that carnivorous animals have the alimentary canal only about four or five times the length of the body, while some of the herbivorous animals have the alimentary canal twenty-eight times the length of the body. So where we find modification in the diet we find modification in the alimentary canal, as well as in the teeth.

Dr. Spalding: I would like to have Professor Peirce answer another question. He states that the habit controls the measurement and formation of the jaw and again that the food consumed and the habit of diet control the measurement and formation of the jaw. I would like to know how it was with the first individual of that species. Where did the habit come from that gave him that particular formation in the first place.

Dr. Ingersoll: We understand that the development of the stomach and the teeth are contemporaneous—that when the child has arrived at a period of development when it needs solid food, its teeth are developed, and contemporaneously with the teeth the stomach is developed for the digestion of solid food. The question is, if the child has no teeth would it have a stomach. In other words, does the development of a stomach depend upon the food habit? Do these sustain the relation to each other of dependence one upon the other—one consequent upon the other, or are they simply contemporaneous and yet independent? For instance, here is a little child among my patrons more than two years old that never had a tooth in its head. Has it never had development of a stomach? I see no reason to believe it has not a good stomach. There is a man in Pennsylvania more than forty years old who has

never had any teeth, first, second, nor third set; and yet the man is in vigorous health and takes solid food. Another curious fact is, that he never had any hair on his body and no sweat glands. I do not know what other eccentricities nature has performed in his case, but so far as the newspaper statement is concerned he has never had any hair or teeth, and yet has a good, sound stomach, so far as I know, which shows that there is no necessary relation between the two developments, although they are contemporaneous.

Dr. Atkinson: The man referred to has a son just like him.

Dr. Sitherwood: My observation accords with the views put forth in this paper, and I heartily commend it. While there are some apparent exceptions, yet it seems to me that the rule holds good, and in these days we are putting entirely too much confidence in the feeding of phosphates and the chlorides and all kinds of mineral substances. I have always been the friend of children. I came to this association leaving a very sick child, only ten months old. The physician that is attending the child has had nearly twenty-five years' more experience than I, yet because of my faith in the things set forth in that paper, I gave positive orders that no more mineral medicines should be given to the child, none of the so-called patent mixtures that are prepared as children's food, but that it be given fresh cow's milk and vegetable stimulants, and the very first dispatch that I received told me that the child was better. I have received two dispatches daily, and one received this afternoon states that the child was nearly well.* While there are seeming exceptions in the case of lime taken for the egg-shell, and the salt taken into the human system, I claim there is something in this which we do not understand; but as a rule we must obtain the phosphates from vegetable substances that are already organized.

Dr. King: It occurs to me that we are assuming something that we cannot fully sustain. Dr. Atkinson assumes that when we are hungry, we are not hungry in the stomach, but in the part that needs to be supplied with food, whatever part that may be. My experience has been that when I am hungry and fill the stomach, my hunger is satisfied at once. Is the part that is deficient satisfied? We assume that because we do not get immediate results by the use of phosphates we are not getting any benefit. We must remember that these deficiencies have been going on for generations, and we cannot expect marked results immediately. It may take generations to restore them.

* The child quickly recovered under the treatment, and is hearty and well.

Dr. Atkinson: Whenever anything I say is impugned I want, in the cause of love and wisdom, always to correct it or be corrected myself. The proof that the hunger is not in the stomach is this: when the individual is hungry and from a false mental interpretation has referred the sensation to his stomach he has entirely misapprehended the fact. He would not be hungry if he would put on a belt and draw it up as the Indian does, thus bringing the walls of the stomach and the entire contents of the abdomen in close enough proximity to keep up the blood tension that will carry the blood to the needy territories.

Dr. Barrett: It is true that hunger of the tissues is felt in the stomach and the supplying of that organ with the pabulum satisfies the craving. But that is not the only way in which hunger may be satisfied. People are kept alive for weeks, and their whole systems nourished by injection. There is also a thirst of the tissues for fluids. That thirst is satisfied by the swallowing of a certain amount of fluid, which is carried into the stomach. But that is not where it is needed. You can satisfy the thirst just as well by injecting fluid into the blood. The stomach may be empty if the tissues are fed. Certain tissues can be fed without the instrumentality of the stomach.

The nomenclature that we are obliged to use because of the paucity of words is very unsatisfactory, but it is the best we have; and in addressing an audience of this kind it is necessary that we use the terms in common use.

I desire to lay it down as a general law—and general laws have their exceptions—that the animal organism, under no circumstance, can use foreign substances for the production of trophic changes. I said further that it was the province of the vegetable kingdom to organize from the inorganic, that when once organized the animal kingdom may take it. One of the speakers cited one exception as a triumphant refutation of a broad general principle—that lime was necessary for the production of the egg. Lime is not at all necessary for the production of the egg. The shell is properly no portion of the egg; it is simply the protective, extraneous covering which is intended for the protection of the egg. The ovum is the ovum, whether it be incubated within or without the body. In certain of the animal kingdom the ovulation and the incubation are entirely within the body, and the animal is brought into the world in a comparatively complete state. In others the incubation takes place outside of the body of the mother, and it is necessary that some pro-

tection be furnished, and the lime is simply the outside covering, and forms no part of the chicken itself.

Dr. Friedrichs: May I ask the gentleman a question? Do you assert that the shell is not necessary to the ovum?

Dr. Barrett: Yes, sir.

Dr. Friedrichs: It is admitted in all the works that I have seen by persons who have made a study of development that at a certain time the shell becomes porous by the chick absorbing the lime from the shell in order to form its bones.

Dr. Barrett: That is hardly worth answering. Any assertion that I make, I make upon my own responsibility. It is the province of any gentleman or the society to enter any protest that they may choose. I hardly like to have my argument interrupted for the sake of protests. In those animals in which reproduction is completed entirely within the body there certainly is no egg-shell. There are many inorganic substances which are necessary within the body for the purpose of holding in their proper condition other substances that may exist. Dr. Atkinson has very clearly answered some of the arguments which were introduced here for the purpose of proving that crystallizable substances, as chloride of sodium, were necessary ingredients in the human body. So there are inorganic matters which really play no part in nutrition, but which simply exist in the human body for other reasons. I mean that they are not built up into the tissues as such, but they seem to exist there, so far as our physiological investigation goes, for the purpose of keeping and holding, in the proper condition, in the proper solutions, some ingredients which may be necessary to nutrition. Chloride of sodium has one important function within the human body. It changes the density of the fluids in the neighborhood of the animal membranes so that osmosis may go on. That is one of the reasons ascribed by physiologists for the necessary presence of chloride of sodium.

The average length of the digestive tract, which in the carnivora is about five lengths of the animal, while in some of the other orders it is twenty-eight lengths, teaches us that the higher the organization of the pabulum, the less it needs of digestive tract for its proper assimilation.

Dentists have been for a long time in the habit of prescribing the earthy phosphates in certain conditions for the sake of building up the system of the mother and child. Is it a correct practice, or is it not? I have attempted to show upon what physiological principles is founded my belief. I believe it to be a general rule that the in-

organic matters are not built into the system. If the system needs carbonate of lime or phosphate of lime, it will not take them from any ready-made source. It must elaborate its own material, under all circumstances. If nature needs carbon it will elaborate carbon from the food. If it wants phosphate of lime it will eliminate the elements which go to make up the phosphate of lime and build them into the tissues as a phosphate. It will not take any inorganic compound whatever and build it into the system as a compound.

Dr. Peirce: It is well known that the rocks upon which the city of Paris is built and those in the Straits of Gibraltar are made up of the external skeletons or shells of little infusorial animals. Lime has been taken out of the sea by these microscopic objects and deposited, miles in extent and thousands of feet deep, making the lime rocks upon which large cities have been built. That lime is already organized to the same extent as that found in vegetable or animal tissues, not differing to any extent in kind, but only in degree.

Dr. Barrett: I desire to know whether the gentleman calls the product of the coral polyp an organized substance?

Dr. Peirce: As much organized as the lime we find in the grains, where the lime is taken from the earth. The shell is an outgrowth from a pulpy body.

Dr. Morgan: One of the speakers assumed that the peculiar character of the development which we meet with in the animal creation was due to the food habit. I apprehend that the facts in the case are that that development follows a type, the result of a force that had gone before, and that my friend from Philadelphia got the cart before the horse. There are certain typal forms that belong to all animate and inanimate nature. That they are modified by the food habit is very true, but they are not created by it. The exercise of the muscles and the food upon which the individual lives have something to do with his form and the character of its development. So, in the use of the organs of mastication, while the food which we use has something to do in the way of modification, it has nothing whatever to do with the typal form. That has already been set, and its development takes place very much in proportion to the manner in which we masticate, as the blacksmith's arm is enlarged by constant use. Wherever there is a want expressed in the animal economy, it is a promise that that want is to be supplied. In other words, in the design of our organization there never was implanted a desire, either mental or physical, in the human body that did not carry with it the promise from the crea-

tive power that it was to be satisfied. In the differentiation of the pabulum for our bodies, we simply select that which is already prepared for us. There is a call for lime-salts, and nature has provided it everywhere abundantly in all the food which we take. You may take that which is the poorest in lime-salts upon which the human body can feed, and there will be found a sufficient quantity of mineral matter to satisfy all normal demands. Therefore I deprecate the idea of introducing mineral matters into the body for the purpose of building up tissues. I do not know that we can take the broad ground that was taken in the paper that no inorganic matter could be assimilated. I do not know but that there is a potency given to mineral matters, in some cases, after they have been taken into the system, so that they may be appropriated.

We know that iron is incorporated in the blood. It is not blood unless it has iron in it. I do not know how that is introduced there. Sometimes we may get it through vegetable matter, but we can administer the chemical salts of iron and increase its quantity in the tissues. I do not know how much potentiality is given to it, after it is carried into the system, so that it may become incorporated and a part of the tissue. So, I am not prepared to take the broad positive ground that it is impossible to introduce inorganic salts and have them incorporated into the tissues. But the other position is taken, that all the inorganic materials necessary to man are incorporated in all the food upon which man lives, and that there is no necessity for going outside for them. You may examine persons whose teeth are very inferior, and you will find the teeth incrusted with large quantities of phosphate of lime, showing that nature has more than she has any use for, and has thus thrown it off. The trouble is want of assimilation. We digest food often, but do not appropriate it. This is the point to which we have to look if we propose to remedy the present deteriorated condition of the teeth in the human family, especially in civilized life, and when you get back to the point where you are able to see clearly and regulate the matter of assimilation you will cease to be bothered as to the question of how much lime-salts are needed, and how they shall be given.

Dr. Patrick: We all readily recognize the long-established fact that all matter is included in two great divisions, the organic and the inorganic, which are again divided into three kingdoms, the mineral, the vegetable, and the animal. It would be well enough to call attention to the order of succession in creation in regard to these three kingdoms. First, the mineral, because it would be im-

possible for the human mind to realize such a thing as a vegetable kingdom without the pre-existence of the mineral, and in the same way, the animal succeeds the vegetable. There is nothing more certain in physics or philosophy than the consumed pre-existing the consumer. Physiologists and naturalists all agree that the vegetable elaborates material from the mineral, and the animal elaborates muscle and bone from the vegetable. Animals are incapable of sustaining themselves by forming living matter or protoplasm from the inorganic world, but absolutely need for their subsistence a food consisting of organic matter already formed. Now, these proteinaceous alimentary principles once stored up in the cells of vegetables and certain simple forms of animals, other animals could exist. Thus, the ruminants, which live exclusively on vegetable matter and form by far the largest class of the animal kingdom, must have preceded in the order of creation all those animals that live exclusively on animal matter. A lion cannot live upon grass as the ox, but he can live upon the ox after the grass has been transformed into the ox. There are certain forms of matter that are called proximate principles. These forms are divided into classes, and it is only in the fourth division that we find the protein compounds or organic substances, which contain all the elements of the other classes locked up in the vital cells of organic life ready for the animal's use. Proteids are tissue-formers. Tissue cannot be produced without them, and mineral matter cannot be taken into and appropriated by an animal until it has first passed into vegetable matter and become organized, forming vital food through the agency of the vegetable kingdom.

I was somewhat surprised, last night, to hear my friend Dr. Spalding say that chloride of sodium could be taken into the system and appropriated. Chloride of sodium, like water, is found in every tissue of the body with the exception of the enamel of the teeth; it regulates the phenomena of endosmosis and exosmosis; it excites the digestive fluids, and in this way assists the whole process of digestion; it is deposited in different parts of the body; it finds its way into the very inmost substance, or paryenchyma, of the body. I shall not detain you by attempting to describe the work it does, for I do not know all of it. I know some of it. I know that it is a stimulant. I know that it sets molecules in motion, and I know that after it has done its work it passes off from the body with the urine, mucus, and perspiration, in solution with the water of these fluids. I know it combines with other minerals, but not with any living cell. There is

nothing you can make animal tissue out of but that living substance known by physiologists as protoplasm.

There is an anatomical reason why the teeth cannot be reconstructed by the administration of mineral substances taken into the system. Teeth are developed like bones. The hardening salts in both cases are deposited in preformed cells or cavities organized in a pre-existing mold or matrix of animal matter; but they differ in the direction of the deposit, which in bone is from the center to the circumference, in tooth from circumference to the center. The process of calcification in bone is *centrifugal*, in tooth *centripetal*. Therefore a tooth, when fully formed, being exposed to the influence of external agents, is subject to injury or decay, but has no inherent power of reparation, and it can only increase in size, after its formation is completed, by the growth of its most highly-organized constituent, the cementum. The cement always closely corresponds in texture with the osseous tissue of the same animal, and this is so true, in every instance, that comparative anatomists find it a sure guide in the determination of the nature and affinities of extinct species of animals where they could not reach such conclusions from a section of the tooth itself. The formative process of the human teeth is by conversion of and not by transudation from a pre-existing pulp, as in the incisor teeth of rodents and other animals where the pulps are persistent. Hence we find that the teeth of man, both deciduous and permanent, when in a healthy condition, and having served the purpose for which they were designed, become solid, having no internal cavity. This is caused by the conversion of the pre-existing pulp into tooth-substance, and the reason why the last dentine deposited is not exactly in appearance like the first is simply the failure of energy. If a living tooth should be fractured in the region of the cementum, it will be capable of repairing itself; but the dentine, when once formed, will not be capable of repair if broken or fractured above the pulp; for, owing to the direction of the deposit being centripetal, it blocks its own way for reparation. How can mineral substances, or even protein foods, be expected to repair a decayed or wasting tooth independent of or beyond the influence of its formative pulp, whose only office appears to be to secrete and deposit dentine.

Dr. Thompson: This question turns upon the difference between the digestive powers of animal protoplasm and vegetable protoplasm. Vegetable protoplasm elaborates the proximate elements from the mineral, or as we say, *in*organic substances, while animal proto-

plasm appropriates those elements to its own use after they have been thus elaborated. The process of the formation of the proximate elements by vegetable protoplasm we know nothing of, but we can appreciate and understand how those elements are appropriated and used by animal protoplasm in the building up of animal tissues. All animal structures are but modified protoplasm. Man is different from the mere amœba,—which is but a body of pure protoplasm floating in water,—in that he has permanent extensions supported upon a bony skeleton, and muscles, which perform the duty of moving this frame-work or its extensions, and in having separate organs which answer the purpose of distribution of nutrition, etc. But after all he is but a larger mass of protoplasm, differing only in its qualities from the smaller amœba. Vegetable protoplasm in its analysis contains about forty proximate elements. Animal protoplasm has never been analyzed to such an extent that we can understand its elements and structure. The analysis of vegetable protoplasm is almost constant in all vegetable cells, but animal protoplasm is very variable. In the most dense structures, as the teeth, this protoplasm is very limited in quantity, because the inorganic lime-salts are in very large proportion; in muscle, in connective tissue, etc., different substances exist, so that the analysis of different kinds of animal protoplasm in different organs and tissues varies infinitely. The whole question turns upon the digestive powers of this protoplasm in its ability to appropriate non-vital elements from the inorganic world, and we all admit that animal protoplasm is not capable of appropriating mineral elements, but that they must first be elaborated by vegetable protoplasm into proximate elements.

Many things are used in the way of food which are really only medicines. Take the preparations of maltine and various things which are in themselves vegetable and are proper as foods: we cannot, with any certainty, direct those elements to the parts which we wish to influence. For instance, in the building up of the teeth and bone, we do not know that phosphate of lime, if we administer it, will be carried to the bones and the teeth; we cannot direct it. All the formative and the nutritive organs have a well-defined power which causes them to select from the pabulum that food which they need for construction and nutrition, and phosphate of lime is found in all the tissues. It is one of the principal elements of the body, so that in the administration of this as a food we have no certainty that we can affect the part which it is desired to benefit and pass by other tissues. Assimilation is the great thing in nutrition. It may

be weak in general, or a particular part may be diseased, so that there will be no power in that part to assimilate nutritive substances from the pabulum, and we cannot oblige the part to assimilate the proper element from the blood, even if we should administer what is required. So that two principal obstacles are in the way of special dieting for the development of special tissues: 1st, malassimilation, special or general; and 2d, the impossibility of directing nutrition to special parts or tissues.

Dr. Spalding: I was either unfortunate in expressing my ideas or I must have been misunderstood. My friend from Illinois did not certainly understand me to say what I intended to say, and what I supposed I did say in regard to common salt. What I intended to make clear was that common salt was taken in food by men and animals, and that it appeared unchanged in the excretions. Then I raised the question whether a portion of that salt could be appropriated. I stated that it had not been determined whether the excretions contained the same quantity of salt that had been taken into the body, and if they did not contain the same amount, we inferred that a portion had undergone decomposition. The probabilities are that a portion does undergo decoposition. That is an undetermined point, so that the view which my friend refers to as having been stated by me is not one that I intended to place before this body.

Dr. Darby: If I understood Dr. Barrett, he said that inorganic substances are not appropriated by the animal system. It seems to me that I can recall instances where they are appropriated by the system, or at least where there seems to be such a hunger or demand in the system for them that the inference would be that they are appropriated.

A physician said to me, some years ago, that he had a child under his care suffering from rickets, and so great was the demand of that child's system for lime that it would crawl to a place where the plastering had been broken in the wall, and it had eaten a place out of it two or three feet square.

I suggested that he put the child upon a treatment of lacto-phosphate of lime and cod-liver oil. He did so, and some months after told me the child had ceased eating the plastering. Why is it, I ask Dr. Barrett, that the anemic school-girl eats chalk and slate-pencils? Why is it that the pregnant woman has such an abnormal appetite for lime in one form or another? It is because there is an unusual drain upon her system in the formation of the osseous sys-

tem of the embryo she is carrying. Dr. E. C. Kirk, of Philadelphia, relates two cases which came under his observation, which illustrate the truth of the statement that lime is appropriated by the system, though it be taken in an inorganic form. One woman while pregnant was in the habit of mixing a saucerful of whiting and water, and eating it throughout the day. The other woman had such a craving for lime, while in a pregnant condition, that she could scarce pass a mortar-bed without taking the lime therefrom and eating it, and she did eat largely of plaster, chalk, and the like. I hardly think there would be such a demand in the system for these inorganic substances if they were not appropriated by it.

Attention has been directed by one of the speakers to the importance of feeding children largely upon food rich in the phosphates. Parents often start out well in their efforts to furnish their growing children with good bone-making and teeth-hardening food, but they do not persevere in its use. A few ounces of such food, or a few doses of lacto-phosphate, will not have a very marked effect. "One swallow does not make a summer;" neither do a few doses of lacto-phosphate change the character of the teeth: but if its use were continued for months or years, the benefits would doubtless be apparent.

We are too impatient for results, and because we cannot always see the good effects of remedies administered, we are prone to say that they are of no use. Nor can we tell how much worse the condition might have been had we not made use of them. Agassiz, who was a great advocate of fish food for brain development, was once walking along the New England coast with some friends who knew his theory, and it chanced that they came upon an idiot boy who had always lived upon the coast, and had been raised upon fish. His head was scarcely larger than one's fist. "Here," said one of them to Prof. Agassiz, "is a fine illustration of your theory of fish food for brain development." The great naturalist looked at him for a moment in silence, and then replied, "Yes, but what might he have been had he not lived upon fish?" We cannot tell what might have been the condition of the human teeth if the phosphates had not entered as largely as they have into the system in the form of food, or even as inorganic substances.

Dr. Atkinson: A great difficulty in this discussion has been that we have called the same thing by so many different names that a man has to be very well endowed and wide awake not to get into antagonism in thought with the mental activity of those who are

speaking. I wish to go back to the beginnings and say what is my view of the function of iron in the organism. It is conceded that it is necessary. It is not known that it has any permanent abode in the body as anything but coloring matter and effete matter. Oxide of iron is the constituent of the blood in its first formation; we know it takes a half measure of oxygen, which converts it into sesquioxide of iron. That is the first magnet in the organization. The purpose of that is to invite oxygen to hang about the red corpuscles with a sort of oxygenating grip, a courting grip, not a marrying grip. Then we get something in the shape of the breaking up of the courtship that is not exactly a divorce, although they are separated. The red blood-corpuscle, going to the air-cell in the lung, invites four per cent. of the oxygen within the grasp of the cell, and carries the molecules of oxgen through the blood column until it comes within the sphere of the courting influence again in the needy territory. It now becomes a non-magnet or soft iron, and it goes back to the lungs and is remagnetized. I have given you the last bottom letter of the alphabet of function in the mammalia or the red-blood animals. If we had this we would get rid of that great stumbling block, organic and inorganic.

SECTION III.

Dental Literature and Nomenclature.

Nomenclature and Terminology.

Paper by W. H. ATKINSON, of the Section.

IN the efforts to do a kind of work for this body which no one else belonging to it was willing to risk undertaking, I have been made aware of the sense of wisdom and personal safety in dodging the responsibilities involved.

So long as I had the ear and encouragement of one who was sent of heaven to bless dentists, successive annual efforts to work at this problem were continued. When he was gone, and the irradiancy from his benign presence was denied or withheld, and the virulence of darkness was seconded by those who ought to have known better in what direction to turn their kindly regards; this added affliction was too heavy and murky to permit the recipient to continue without break to hold himself in listening attitude to the angel-band desiring to lead us in a sure path to the attainment of Truth and a mode of its better expression. The soul-scars from the former infliction having somewhat abated the smart of a sense of being alone, the influences now let him again strive, like Adam, to arouse from the "deep sleep" sent for his illumination, to see the way wide open to the Tree of Knowledge and to the Tree of Life!

Ripening and Ripeness.

Ripening is the completion of process; therefore, to understand the subject, classification of process must be *formulated* and its limitations nominated, to reveal the type and character of the territory in which the purpose of the process is elaborated in producing and maintaining functioning bodies.

Pro-duc-tion is forward leading of something which is led by that which leads it. This involves conscious and sub-conscious order of

movement. Consciousness is independent of time and space until minification, or arrest of movement, produces sub-consciousness, the interactions of which produce sentiency (sentient being), whose modes are manifested in the senses as departments of conscious and sub-conscious movements. These motions are never strictly separated, for the latter are but the steps or aspects of the former in the career of accomplishment of pur-pose. This last involves intellectual and affectional modes.

Definiteness of purpose, then, is (gives) the limit of function and form to the body or machine through which the function is made provable to sensuous perception, thus establishing the means of differentiated perception known as the five senses, viz.: touch, taste, smell, audition, and sight.

The first act of sub-consciousness is the perception of being minus —alone—loneness. And from this arise the movements which are the steps of inquiry leading to ripeness of the stages of mental and bodily processes. Sound mental action is regular, seriated, stop-and-go-on of consciousness in accordance with purpose. Unsound or unripe mental action is irregular, purposeless, or diverse intention, preventing completion of purpose (end of desire, satisfaction).

Satisfaction of awakened desire is ripeness. Just so long as any awakened bond of affinity is not fully incorporated into the company it seeks, the body is unripe, and therefore maintains its identity. But so soon as all bonds are at rest, the voidness of intensity invites irradiant extensity, and rottenness or disruption of the company results.

Stop and go on furthers ripening: Stop and go back hinders ripening: Stop and diverge favors parasitic productions, or destruction of the bodies in which the special plan of body is interfered with.

Unsteadiness of purpose results from the striving of a subconscious mode to dominate the manner of presentment of the purpose of (super-typal) consciousness. This deflection of irradiancy is the point of differentiation in consciousness which precedes and limits the differentiations of bodies in which function is displayed, from lowest to highest, from simplest to most multiple and complicated.

Sleeping atoms are alone, *i.e.*, unconscious and inactive. When awakened to the perception of their loneness, the bonds of affinity clamor for company of answering kindred, not to put them to sleep again, but to make them happy by mutual compensations of interchange of that which they find they have in possession.

When the hunger of voidness is met by satiating fullness of radiancy, the clamor moderates, and the figure is changed to molecular dance, in which the stop and go on are harnessed together to so fit them in ripeness as to be able to take on another more complicated form (corpuscle).

As mutual impartation of inmost possession produces the first form of differentiated body—the molecule—it will be perceived that each step in advance, by complication of function, and its channel, is effected in a like manner, *i. e.*, the stopping and storing of radiancy in quantity and quality gives the measure and potency of each differentiation in the structural series by which function is revealed and proved in molecules, corpuscles, tissues, organs, and systems in which the radiant and irradiant consciousness is displayed.

Irregular aggregation of molecules can only give molecular mass, all on the same plane of endowment, and therefore classifiable together as one order of existence. When further impact of radiant energy is stopped and stored in molecular mass, so as to enable it to arrange the molecules in regular order, the *corpuscle* is produced, holding more complicated values of affinity, by which endowment it becomes able to stop and store further measures of energy that fit it for arrangement in *tissue* in typal order.

In like manner of stop, store, and go on of energy, organs are built of tissues, and systems of organs, throughout the vast range of inhabitants of planets.

Perspicacity of nomenclature and classification demands the settlement of the question of germs,—bodies capable of storing typal energy —form,—as precedent steps in kingdom, class, order, genus, species, and variety. The specific requirement is to determine the lowest form of body capable of storing heredity (parental similitude). If the researches of mycologists are to be relied on, we must accept smallest corpuscles as germs capable of changing molecular mass into the forms of their own bodies, which, by fission, or production of spores, are able to perpetuate their kind wherever conditions are favorable. These are so small, and so little is definitely settled as yet, that further and more numerous observations must be made to get on solid ground for classification of these foresteps in the production of more complicated forms, heretofore principally studied in their mass presentments.

Attempts to formulate career in consciousness and in physics (nature) thus far are referable to a figment body (atom) and assumed changes in its position (motion). This is the basis of the boasted certitude of "scientific" postulates.

Misty as this cloud-mass of mind and matter truly is, yet it holds the pure milk of the word by whose mandate worlds and their inhabitants are made to appear and disappear in the career and order we are striving to comprehend and describe. The completion of the steps of this orderly lay-out of career constitutes ripening and ripeness of the concepts in mental action and the appearances to sensuous perception of masses which are material embodiments of these concepts of consciousness. In attempting to account for the origin of the atom we become lost in cloud-mass of mind and matter. To make a positive start we have to begin with an assumption, and that is: atoms are unoriginated, eternal bodies, of motic and static possibilities. With this postulate as base we are easily and naturally led to contemplate ether, gas, vapor, cloud, water, colloid, and solid, the union and communion of all of which, under the guidance of impartation of consciousness and subconsciousness, arrange functioning bodies of atoms into molecules, corpuscles, tissues, organs, and systems, in which the purposes of existences are regularly displayed to the inquiring, expectant mind.

Ether is undifferentiated diffusion of first possible postulates in atomic mass (spacic plenum). Disturbance of the diffuse tension in ether generates molecular mass, the first apparent form of which is cloud-mass (clouds). That which occasions disturbance of repose is awakening energy, the measures of which are criteria of constitution and character of all processes in mind and matter to which are attributable interblendings known as ripening of mental concepts and forms and longevity of bodily career.

Gas is aggregation of either atomic mass or molecular mass, in accordance with the simplicity or complicity of its constitution.

Vapor is disjoined mass of whatever form—nebula (cloud).

Cloud is made perceptible by arrest, refraction, and reflection of light, and is produced at will by regulating the heat tension in humid atmosphere.

Water is molecular mass resultant upon awakening and engagement of bonds of affinity in oxygen and hydrogen,—the mineral, earthy, universal, solvent.

Colloid is glue-like body, composed of water, carbo-hydrate, nitrogen, and a little sulphur (one-half of one per cent.) in gluten—glue. (Protista, Protophyta, Protozoa, etc.)

Solid body is metallic body and metallic oxide body of either atomic mass or molecular mass—Crystal.

Inhabitants of planets are the product of agitations in planetary

elements by air processes, fire processes, water processes, and earth processes, guided by intellectual and affectional modes of consciousness. Air supports combustion (fire), water modifies or puts out the fire, and the earth is formed by precipitation of the ash and dissipation of the gas. Thus, the earth, the atmosphere, and the empyrean are made to appear as the observable theater of functional activities.

The base of *being* and *acting* is the trinity of

I. LIGHT.
II. EMPYREAN. } = Love and Wisdom.
III. CONSCIOUSNESS.

Interactions of these produce from Gravity (filling empyrean)—1. Ether. 2. Gas. 3. Vapor. 4. Cloud. 5. Water. 6. Colloid. 7. Solid.

These are the presentments of conscious and subconscious modes of love and wisdom in planets and inhabitants of planets, *ad infinitum*.

SECTION III.—Continued.

Nomenclature of the Teeth.

Paper by W. O. KULP, of the Section.

"In all sciences nomenclature is an object of importance, and each term should convey to the student a definite meaning."

The above from the pen of Chapin A. Harris gives evidence that *he* realized the need of a proper nomenclature for the science of dentistry; but I fear the importance of this subject has been lost sight of by past and present writers upon operative dentistry, for as yet we do not have a universal and methodical system of naming divisions of the teeth, or the surfaces and the particular points liable to be the seat of disease needing the attention of the operative dentist.

We have only a sort of general, or I might more properly term it individual, classification, for each writer or speaker upon the subject uses his own terms, all differing from each other.

The profession of the future will demand from us a uniform nomenclature in this department, as well as in all other sciences, so that, when the graduate from an Eastern school speaks of a certain cavity in a given tooth, the graduate of any other American school will at once recognize his meaning, and the term used as belonging to the profession.

Recognizing this lack of system, and having the fact of the necessity of some uniform method forced upon me as a teacher in this branch of our profession, I adopted a nomenclature in operative dentistry which proved highly satisfactory to me in the final examination of my classes, and I have reason to believe is fully as satisfactory to the majority of the individual members of the classes. I therefore present it to the profession through this body, at least as an aid in the right direction, if not adopted as I present it as a whole:

Names of the Teeth.

1st. Central Incisors, right and left, upper and lower.
2d. Lateral Incisors, right and left, upper and lower.
3d. Cuspids, right and left, upper and lower.
4th. Bicuspids, first and second, right and left, upper and lower.
5th. First Molars, right and left, upper and lower.
6th. Second Molars, right and left, upper and lower.
7th. Third Molars, right and left, upper and lower.

The Surfaces of the Teeth are divided as follows :

First. Including the six anterior teeth, above and below (Incisors and Cuspids).
1st. Labial surface.
2d. Lingual surface.
3d. Proximal surface.
4th. Occluding surface.

Second. Bicuspids and Molars, above and below.
1st. Buccal surface.
2d. Lingual surface.
3d. Proximal surface.
4th. Occluding or grinding surface.

Third. Division of surfaces longitudinally.
1st. Grinding or occluding surface third.
2d. Middle third.
3d. Cervical third.

This division embraces the tooth from and including the cutting edge to the alveolar process.

Fourth. Subdivision of surfaces of the individual teeth.
1st. Right and Left Central Incisors, above and below.
'a' Labial surface.
'b' Lingual surface.
'c' Occluding surface.
'd' Centro-proximal surface.
'e' Latero-proximal surface.
(Occluding, middle, and cervical thirds).
2d. Right or Left Lateral Incisors, upper and lower.
'a' Labial surface.
'b' Lingual surface.
'c' Occluding surface.
'd' Centro-proximal surface.
'e' Cuspo-proximal surface.
(Occluding, middle, and cervical thirds.)
3d. Cuspids, right or left, upper and lower.
'a' Labial surface.
'b' Lingual surface.
'c' Occluding surface.
'd' Latero-Proximal surface.
'e' Bicuspo-proximal surface.
(Occluding, middle, and cervical thirds.)

4th. First right or left Bicuspids, upper and lower.
'a' Buccal surface.
'b' Lingual surface.
'c' Grinding surface.
'd' Cuspo-proximal surface.
'e' Bicuspo-proximal surface.
'f' Bicuspo-fissure.
'g' Buccal cusp.
'h' Lingual cusp.
(Grinding, middle, and cervical thirds.)

5th. Second right or left Bicuspids, upper and lower.
'a' Buccal surface.
'b' Lingual surface.
'c' Grinding surface.
'd' Bicuspo-proximal surface.
'e' Molo-proximal surface.
'f' Bicuspo-fissure.
'g' Buccal cusp.
'h' Lingual cusp.
(Grinding, middle, and cervical thirds.)

6th. First upper Molars, right and left.
'a' Buccal surface.
'b' Lingual surface.
'c' Grinding surface.
'd' Molo-proximal surface.
'e' Bicuspo-proximal surface.
'f' Central fissure.
'g' Cross fissure.
'h' Posterior buccal prominence.
'i' Anterior buccal prominence.
'j' Lingual prominence.
(Grinding, middle, and cervical thirds.)

7th. Second upper Molars, right and left sides.
'a' Buccal surface.
'b' Lingual surface.
'c' Grinding surface.
'd' Molo-proximal surface.
'e' Third molo-proximal surface.
'f' Central fissure.
'g' Cross fissure.
'h' Anterior buccal prominence.
'i' Posterior buccal prominence.
'j' Lingual prominence.
(Grinding, middle, and cervical thirds.)

8th. Third upper Molars, right and left sides.
'a' Buccal surface.
'b' Lingual surface.
'c' Grinding surface.

'd' Molo-proximal surface.
'e' Posterior surface.
'f' Central fissure.
(Grinding, middle, and cervical thirds.)

As the forms of the lower molars differ somewhat from those of the upper, and the locations of attacks of caries vary somewhat, I found it necessary to extend the classification, to cover only the grinding and buccal surfaces, all other surfaces coming under the same names as the upper molars.

9th. Lower Molars, right and left sides.
'a' Buccal surface.
'b' Lingual surface.
'c' Grinding surface.
'd' Proximal surface, as in upper molars.
'e' Buccal pit fissure.
'f' Central fissure.
'g' Lingual cross fissures.
'h' Buccal cross fissure.
'i' Posterior fissure.
'j' Anterior fissure.
'k' Lingual posterior prominence.
'l' Lingual anterior prominence.
'm' Buccal prominences, same as in upper molars.

DISCUSSION.

Dr. Spalding: All those who attempt to teach the branch of operative dentistry have long felt the want of terms of exact definition. In a young profession like ours there is a lack of definiteness in the use of terms prevailing generally, and it is especially prevalent in the manipulative and mechanical departments of our art. In the Section, the paper was considered to be the best presentation of the definition of the various parts of the crowns of the teeth that had yet been proposed. The terms have been carefully considered in the Section, and have been made as brief and as definite as it was possible for us to make them in the short time we had for their consideration. I sincerely hope that the paper will be adopted by the Association, as a step in advance in that direction. The subject of nomenclature is one that has been lamentably at fault and defective in our literature. We know very well how terms are confused; and the same word is often used to express several different ideas on the one hand, while different words are used to express the same idea on the other. This should be corrected, and we should all work in that direction; and whenever a paper like this, or any system like that which this paper contains, is adopted and approved by this body, it should be our

effort to educate ourselves into its use, and to introduce it into general use.

Dr. Thompson: I would like to ask the writer why he rejects the terms mesial and distal in describing proximal surfaces.

Dr. Kulp: My main object in doing so was that the class might understand more minutely and more quickly. If I should say mesial to a class who have never studied dentistry, and whose primary education has been deficient, they would have to hunt up their dictionary to find out my meaning; but if I say lateral proximal or central proximal, that defines the location. The entire plan is made plain and definite. When you begin to classify cavities and fillings you will find further difficulties in the terms mesial and distal.

Dr. Taft: The subject of nomenclature is an interesting and important one. Accuracy in conveying thought depends on the words used for that purpose, and they should be as far as possible definite, and at the same time those that will be most easily and readily comprehended by the hearer. As our profession improves its nomenclature and distinctive language, so will thoughts and ideas be more clearly and more definitely expressed. It is well to discuss this subject in this body, and in all similar bodies, but in our schools it can receive more attention, and the results will be greater than it would be possible to attain here or in similar bodies Those who are engaged in the instruction of young men who are soon to enter the ranks of our profession, should be led in the right path in this respect. Those who teach should have definitely in mind and for use a nomenclature that should be generally adopted. The paper which Dr. Kulp has presented here looks to the teachers of our country as the persons who should adopt this or equivalent naming for the different surfaces of the teeth. If young men are trained for from five to nine months in the correct use of language and a proper nomenclature, they will very likely use such terms about as they have been taught; so we should be particular to avoid misapplication of terms and names. As our young men become better educated they will naturally, from their increased knowledge of the science of language, use it more correctly and with better effect. Not only in our institutions of learning should this subject receive especial consideration, but it should have attention on the part of all who write for our profession. Perhaps we are all more or less at fault, and every one should criticise himself more than his neighbor, and so educate himself in this direction, and then the work would be done.

In regard to the nominations which have been made by Prof. Kulp, they are more definite than anything we have hitherto had. Perhaps the most of them have been employed before, but they have nowhere, that I remember, been systematized as they are in this paper. If I should make any suggestion in regard to the naming which he has expressed, it would be with reference to the word occluding. In order to avoid seeming tautology the word masticate might be better, as it would, perhaps, be more definite if we should give a critical examination to the meaning of the words. The word occlude means to touch or to come in contact with. It refers, therefore, to the contact surfaces of the molars, bicuspids, and anterior teeth, as they are used in mastication. In no case do all the coronal surfaces of the teeth of one jaw come in contact with those of the opposite jaw; they meet at small points. By a critical view of the word, the points that come in contact are the occluding points; but if you use the term masticating surfaces, that will apply strictly and definitely to all the coronal surfaces of the teeth, because when they are brought together the material between them comes in contact with all those surfaces. My own preference would be for the phrase "masticating surface," instead of "occluding surface."

Dr. Morrison: Seven or eight years ago, Prof. Judd, with the assistance of our late brother, Dr. Dean, of Chicago, produced a little monograph on this subject, which has been used, I believe, in Chicago and St. Louis, quite extensively. The terms mesial and distal surfaces are there applied to the centrals, laterals, bicuspids, and molars, which seem more simple than anything here mentioned. I was under the impression that it was more generally known and understood by the profession than it seems to be to-day.

Dr. Kulp: The reason I do not use the word distal is that when it is used before a class it is likely to mislead students in the same manner as the word posterior. The definition of the location would be naturally the point furthest away or behind, and that would lead a student to think the location was on the palatine or lingual surface, and my main object was to have a term that would not mislead any one.

Dr. Taft: My impression is quite in favor of the name given in the paper—the word proximal rather than distal or mesial, because more readily understood.

Dr. Morgan: It strikes my mind that occluding surfaces, as applied to the twelve teeth in the front of the mouth, is incorrect. They do not, in their natural position, as a rule, occlude, nor do

they generally occlude in cutting. Indeed, the incisors and cuspids scarcely have surfaces to occlude. They are cutting edges. They do not occlude when they are at rest, and they do not occlude in mastication.

Dr. Spalding: These points were very carefully discussed in the meeting of the Section, and there was but one word suggested that would apply to all the teeth, as far as the cutting and grinding or masticating surfaces are concerned. If we use the term masticating, it distinctively belongs to the molar and bicuspid teeth, and not to the front teeth. We should be driven to the necessity of using another term—incising or some term equivalent to that. The term occluding was not as properly applicable to the front teeth as the back teeth, but the object was to avoid multiplication of terms, and bring them down to a single one, which would apply to all teeth, and, as far as the members of the Section were able to suggest, the term occluding appeared to be the best term, and more universally applicable than any other. With regard to the terms distal and mesial, the objection to them was that each mesial and distal surface required another and additional designation. The objection was that they were not in plain language, and would not be understood, by patients at least, as well as the English words, and that they had no particular advantage over the other term, and were not so clear in defining the surfaces of the teeth.

Dr. Atkinson: Whenever we attempt to make classifications and name them we have but one standard to direct us, and that is nature's standard. The remarks of Dr. Morgan brought that clearly to my mind, in the example of his own mouth. He has masticating surfaces all around. I have often had patients tell me that their grandfathers had double teeth all around. The term occluding is the term *par excellence* to mean the coming together of the teeth. No man can ever have understood teeth worn down so as to have broad bases to come in contact with each other without having had an occlusion or friction which wore the teeth down, and that settles the philology in my mind, without any further statement, if comprehended.

Dr. Friedrichs: I have been in this Section two or three years, and I do not see what the outcome will be. At Niagara Falls our report on nomenclature was almost snubbed. It was read, but that was the last of it, and that has been about the case with every report in this Section at every meeting. I do not see why we should quibble, if none of the dentists are going to adopt any of these terms. I

think there is only one way that you can arrive at a basis by which we can uniformly adopt one designation for any surface of the teeth, and that would be by the college faculties getting together and adopting designations for use in the schools, so as to have uniformity in all the colleges in the United States. Or, I might suggest that this body appoint a committee of three, and let them take that paper, revise it, and bring it before this body, and let all adopt it as a guide by which we are to be governed.

Dr. Sitherwood: Whether you adopt the names or the terms used in this paper or not, you will be compelled to use them before your students and before your patients. I mean simply this: unless you adopt the simple terms and names here given, you will have to explain what you mean, and is it not better to use such names and such terms that those who hear us will understand what we are talking about?

Dr. Allport: The occluding surfaces of the bicuspids and molars are the grinding or masticating surfaces, but the occluding surfaces of the incisor and cuspid teeth are not their cutting edges, for the superior incisors and cuspids shut over the inferior ones; therefore their occluding surfaces are the cutting ends of the inferior and the palatine surfaces of the superior. Strictly speaking, therefore, the term occluding surfaces as used in regard to the six anterior teeth by the writer of the paper would seem to be incorrect.

SECTION IV.

Operative Dentistry.

Report by E. T. DARBY, Chairman.

THE Section is somewhat embarrassed, owing to the absence of Dr. Shepard, who was elected chairman at the last meeting, and from whom it expected an extended report.

The Section has one paper, by Dr. J. A. Robinson, to report to the Association, and would recommend that it be presented and discussed. It has several subjects of importance which it would suggest for discussion.

New modes of practice are constantly being introduced and their advocates are not infrequently men of such standing in the profession that their opinions are worthy of consideration.

The Section would, therefore, suggest the subject of Bridge-work for discussion; to be opened by Dr. E. Parmly Brown.

The Section would also suggest that the Association discuss the Herbst Method of Filling; to be opened by Dr. M. L. Rhein.

The Perry Separators and the Manner of Working, with a New System of Matrix Filling; to be opened by the chairman of the Section.

A New Method of Ingrafting Half-Bicuspid Porcelain Crowns, by Dr. Noble, of Washington.

A New Dental Splint, shown by Dr. A. E. Matteson, of Chicago.

A New Appliance for Regulating the Exhalations of Patients during operations upon the teeth, by Dr. C. C. Southwell, of Milwaukee.

The Section would also recommend the consideration of a New Method of Ingrafting Artificial Crowns; the discussion to be opened by Dr. Kulp, of Davenport.

SECTION IV.—Continued.

The Painless Operation.

VOLUNTARY PAPER BY J. A. ROBINSON.

NO worse malady can attack a man than to believe there can be success without toil. What we gain by honest days' work is valuable; nothing else is. There is no royal road to learning. When people complain that others are more fortunate than themselves, it is, as a rule, because the most fortunate have the most industry. To believe in luck almost always leads to disappointment. The universal desire of the dentist and his patrons has been to find something that would relieve pain. Can it, has it, or will it ever be accomplished? In tooth-extraction there has been a great advance, but tooth-extraction is not desirable; it is not the highest employment for the dentist, nor the greatest blessing to those who have bad teeth. Our methods must be changed; the destructive must give place to the constructive as society advances. Professions are accepted as elevators of society, as above things merely mechanical. The experience and labor of fifty years have helped to overcome some obstacles and make the path of excellence more easy. It is the daily work of filling and preserving teeth that most interests the dentist and his patrons.

The experience of fifty years may be worth something to beginners, and suggestions may help the more experienced in new methods of treatment. Every one will understand the importance of painless operations, if the thing is possible. In friable teeth, conjoined with anemic conditions of the system, we have the greatest difficulty. Enervated constitutions, whether inherited or otherwise, require palliative treatment in order to obtain control of the patient. Of all the various preparations in use among dentists there is nothing thus far equal to carbolized potash to give relief and obtain the

confidence of those we wish to be passively affected. The little pain attending the introduction of the medicine, in comparison to that caused by the excavator, is nothing. This once done we have a starting point; have gained, in fact; for the positive assurance of the dentist that it *will not hurt* is a confidential help to both patient and operator in beginning. It is particularly so with children. If the cavity is open to the pulp so that it bleeds, apply clear carbolic acid at first to paralyze, then this *remedy* to cauterize the pulp and form a hard eschar so it can be capped with impunity with any of the oxyphosphates.

This relates to those teeth where the pulp is expected to remain alive. When the pulp has been devitalized, adjust your rubber dam, and apply on cotton a solution of hydrochlorate of cocaïne for ten minutes. Open thoroughly the pulp-cavity, with a large bur about the size of the pulp-chamber, then make a second application of cocaïne and press hard against the roots that contain the nerves. Let the cotton remain for ten minutes, and then push the broach down the side of the pulp to the apex, and the operation will usually be painless. In all operations of this character there will be some slight inflammation and soreness, to overcome which requires absolute rest. Be sure to so arrange your fillings that there is no occlusion with the antagonizing teeth; for if in the inflammation that has taken place by superposition of the filling you keep up a constant irritation, you produce suppuration and subsequently loss of a tooth that under the conditions of absolute rest would have been successfully retained. I think it good practice to shorten the cusps, or the antagonizing points of teeth thus treated, for they soon resume their normal condition for mastication. This is easily done with corundum wheels with the dental engine.

So far we have attempted to treat of therapeutics and surgery as appertaining to the teeth. Now, what of the mechanical operations to preserve the dentine and enamel?

Gold is not a success as applied to difficult margins in wet places, especially on the posterior surfaces of the inferior bicuspids and second molars. Amalgams are a constant failure. Dr. Betty, of Cincinnati, has just published a true statement about "textile foil" as a helper in large cavities where the cervical walls extend beyond the gum-line and are difficult to keep dry, on account of the ease to the patient and saving of time; and says, "it prevents the shock incident upon sudden thermal changes, in this way rivaling oxyphosphate of zinc." He also says he does not consider the weld-

ing properties sufficiently reliable to retain the gold cap in place. Having spent much time in the effort of welding gold to textile foil, I can say in truth that I have never known a single failure where the cavity was entirely dry, and very thin No. 6 cohesive foil was at first placed on the textile filling, using coarse-serrated pluggers, and carefully adapting the gold to the surface. When once united, all the rest is as easy as making a filling with cohesive foil. For the past year I have tried experiments with textile foil in combination with amalgam. Amalgams, like miserable people, are often made better by being in good society. So amalgam, when once placed in the cavity and covered with textile foil and the foil pressed into the amalgam till it is dissolved and unites with and becomes part of it, becomes more solid; the foil fills up the interstices, and renders it susceptible of receiving a good surface, and the pressure in making the union carries it closer to the walls of the cavity and consolidates it to a mass that is much like putty; prevents it from changing color, in a good degree, and the combination gives you a filling mechanically composed of silver, tin, platinum, and gold.

To those who expect to get along without hard work this paper will not prove of help, for the quality of the effort is as important as the quantity of physical strength. Firmness must always be combined with gentleness in successful operating. Let us all toil till we see the salvation of teeth, and then we can say with Simeon of old, "Let us depart in peace."

DISCUSSION.

Dr. E. Parmly Brown: The *Independent Practitioner* for January gave a beautiful illustration of a specimen of bridge-work which was said to have been dug up in the ancient necropolis of Etruria. The prince or princess who wore that bridge-work had a gold band extending outside and inside of the structure, so that when he or she smiled, you can imagine—to use a slang term—what a "give-away" it was. The next step in bridge-work which is prominent is that which annihilated the gold band on the outside, and to-day we have bridge-work that shows nothing but the porcelain when the lip is raised. I have a pamphlet here that has a cut of that bridge-work which will allow the lip to be raised, but the wearer must not talk, laugh, or open the mouth, or you will see the golden back and crowns within. But we want the ladies not only to open their mouths, but to laugh without restriction. So I have to

offer you to-day some bridge-work that I perfected last year and have been applying since January of this year. Here is a case of six teeth. When the gentleman who has that in his mouth smiles, he shows nothing but porcelain. When he laughs, gapes, or opens his mouth, and you look inside, you still see porcelain. The metal in this appliance is invisible,—baked through the center of the teeth. The ladies now can show their teeth without "giving anything away."

There are many ways of applying this. I think I can name a hundred different ways of putting it in the mouth. There is a dentist present for whom I applied a case during the spring or winter. He came to my office with the left upper molar prepared to fill; it was a pulpless tooth, a mere shell, having nothing left that was able to withstand the action of the fluids of the mouth. In his case we had also the root of the second bicuspid very short and ulcerated. That was of no use to us for crowning purposes, but the first bicuspid was all right. The intention was to crown the molar with a gold crown, and bridge-in the second bicuspid. I said to him, "We will extract that diseased root and make our bridge of porcelain and apply immediately." I expected a certain amount of absorption, and built the porcelain up far enough to allow for that, letting it project into the socket whence the root had just been extracted, and I said: "After absorption has taken place we shall still have contact of the point of the root with the gum above." The work can be seen here this afternoon at the clinic. Instead of much absorption around that bicuspid, to my astonishment, there is a porcelain tooth apparently growing out of the gum, no metal being visible, and all seems cleanly and healthy. An extra feature of strength is the fusing of the teeth together on their approximal surfaces, where more than one tooth is in the bridge.

Dr. Thomas: Will you tell us something about the strain that comes upon the tooth to which this is attached?

Dr. Brown: The strain is then divided. Three men can generally take a bigger contract than one.

Dr. Thomas: The strain that comes upon the natural teeth, I mean.

Dr. Brown: That objection will apply in all bridge-work. I don't know that there is any special difference between this bridge-work and other bridge-work in that respect.

Ordinary plain- and gum-plate teeth are used for this work, a slot being ground in the back between the pins, if pins will admit it; the

platinum-iridium set in the groove made for it; the pins bent over it to steady matters while the tooth-body is being applied wet ready for baking. Attachments to teeth and roots are made by porcelain crowns, gold crowns, and gold and amalgam fillings, as seen in the several specimens shown.

There is a great field for the display of judgment in selecting suitable cases for the application of bridge-work, which, when properly made, need be no less cleanly than are the natural teeth.

Dr. M. L. Rhein: After meeting Dr. Bödecker upon his return from Europe, I spent a great deal of time with him, investigating thoroughly the subject of the Herbst method, and I have been pursuing that system considerably during the past nine months. I have modified my method of operation somewhat, inasmuch as I do not complete the entire operation according to the Herbst plan.

The advantages that are claimed for this form of operation are chiefly that with it we obtain a better adaptation of the gold to the walls of the cavity than by any other method. This chief advantage has been conclusively proved by clinics that were given before the First District Dental Society in New York City. These clinics are fully reported in the August number of the *Independent Practitioner*, in the admirable paper by Dr. Bödecker, which is a thorough exposition of the subject. The second advantage is that after any one has mastered the method, he can perform the more difficult operations in a much shorter space of time than before. The third advantage is that the patient will suffer less. There is less nervous shock than with malleting. Another great advantage is to be found in the greater ease and rapidity with which large approximal cavities in bicuspids and molars can be filled.

I have mentioned some of the advantages of the method. The only and the great disadvantage that has been pointed out is that the gold is not as thoroughly condensed as by the mallet. This has been also demonstrated, and on this account I have modified my former practice, and Dr. Bödecker has done the same. Almost all who are using this method insert three-fourths or seven-eighths of the filling up to the coronal surface of the work by the Herbst method, and complete the operation with the mallet. In that way they obtain, on the grinding surface, all the density that they would get if the filling were put in entirely by the use of the mallet. I believe by the method of combining the two this objection is met and overcome.

The main feature in this work is that the cavities must all be

reduced to simple ones. When you have an approximal cavity you must fit a matrix, properly adjusted, so as to supply the place of the missing wall, not only in the posterior but also in the anterior teeth. I have some models that Dr. Bödecker had sent over to him from Germany, and they illustrate the method very finely. They are the work of Dr. Herbst himself. In working by this system, it is necessary to use a peculiar kind of gold that is very soft. He has used, in all these operations, the Wolrab gold, which is on exhibition here, I believe. Gold very similar to this has been made during the past three months in this country by The S. S. White Dental Manufacturing Company, and also by R. S. Williams. If this system has done nothing more, it has unquestionably given to the profession a form of gold much superior in the matter of softness to any we have had heretofore.

Dr. Allport: Do you understand that he welds tin?

Dr. Rhein: Dr. Herbst has done so, I believe; but I have not experimented with tin foil. Here are two specimens,—one where the tooth has been split apart. I know positively that the gold is welded together. The gold as sold is in such a condition that it is almost as soft as butter, and it is like running the burnisher into so much cheese. It is rubbed around the tooth, and the gold finds its way into the most minute and microscopic crevices; places which the plugger points will never reach. The Whites call their gold "velvet" cylinders, and Williams his, "burnishing" cylinders. They are new forms of gold that have come out for this especial purpose.

These few disjointed remarks are not intended as a thorough explanation of the subject (that has been done and is in print), but were recommended by the Section to start and continue the discussion of a subject which was left last year at Saratoga in rather a sorry plight.

Dr. Darby: What I have to say upon the subject of separators will be said in behalf of my friend, Dr. Perry, who is not here to speak for himself. I regret that he is not here to demonstrate the use of his separators, which are illustrated in the present (August) number of the *Dental Cosmos*. A year or two after the Jarvis separators were introduced to the profession, Dr. Perry began his experiments in that direction, and in 1877 exhibited one of them at a meeting of the Dental Society of the State of New York, held at Albany. Since then he has made many changes and improvements, and as the result you see this complete set, which I will show

you in position upon these plaster casts. A complete set of them has never been exhibited before, and it would seem that little could be done to improve them. They are admirably adapted to each type of tooth, and are so constructed that great force can be brought to bear upon the teeth to be moved without danger of displacing the separator. The bows are more out of the way of the operator than any before shown, and they are easily adjusted because of their simplicity of construction.

In connection with the separator I desire to show the Woodward matrix. This form of matrix was suggested by Dr. J. A. Woodward, of Philadelphia, and is illustrated in the June number of *Dental Cosmos*. I show you a great variety of forms, some of which are my own, but modifications of Dr. Woodward's. I also show you an instrument of my own, known as a matrix-holder, which is intended to force the matrix tightly against the cervical border of the tooth to be filled. These are also illustrated in the *Dental Cosmos* of the present month (August), in connection with Dr. Perry's separators. The matrices made after Dr. Woodward's plan are very thin, and may be made of steel, copper, or phosphor-bronze. Perhaps the better way of making them is to use a piece of a Seth Thomas clock-spring. It should be annealed and rolled to about No. 28 in thickness. You will observe that each one of these matrices has a little ear, which is intended to rest upon the masticating surface of the adjoining tooth, thus preventing the matrix from being forced on to the gum when packing the gold. You will also observe that there are little serrations on the side of the matrix facing the adjoining tooth; these are designed to hold the wooden wedge in position. In place of the wooden wedges which Dr. Woodward recommends, I am in the habit of using thin steel wedges, made in the shape of a small knife-blade, thicker at one edge than the other. In order to handle these wedges conveniently, I have them made to fit one of the socket-handles. After pushing them to place between the matrix and adjoining teeth, they are then unscrewed from the handle and left in position until the matrix is removed. The little device for holding the matrix, which also acts as a separator, is intended to do away with both the wooden and steel wedges, and has the advantage of holding the matrix firmly in place.

The thin phosphor-bronze matrices possess some advantages over the steel ones. They are more easily made, and then, owing to the softness of the metal, they may be gradually forced out by the pressure of the gold in packing until a full, or even extra, contour of the original tooth is obtained.

Dr. Noble: I suppose you are all familiar with the How tooth-crown, and the principle of putting that tooth on. What I wish to call your attention to is a modification of the How tooth and screw which you will find in all dental journals—a tooth with four pins and a screw placed in the root. The modification which I wish to call attention to is the adaptation of half of the bicuspid tooth where the outer half of a bicuspid tooth has been broken. It makes a very pretty operation to use one of the How teeth in supplying the outer cusp without the removal of the inner. The outer half is fastened to a screw going into one of the roots of the tooth; when the screw is firm and in its position put on the tooth and tighten the pin until the tooth is firm; then the filling can be made by cutting away the amalgam and finishing with a gold plug from each of the cervical borders, going over and uniting on the top, making a very pretty operation. I speak of this as something practical, for I have a large number in use which have given more satisfaction than anything else in the way of a crown or artificial tooth, or half of a tooth, as in this case. By this method we do away, in a large measure, with building up, and avoid those unsightly crowns. This makes a strong operation, and one that I think is very useful. The screw, however perfectly fitted, should be warmed, and a little gutta-percha placed in the root before introducing the screw.

[Dr. C. C. Southwell, Milwaukee, showed a simple apparatus for directing the breath of patients away from the operator, which he designated the dental breath-guard. It consists of a curved metal plate fitting and resting upon the upper lip, with a staple in the center, to which the shield proper is attached by means of a lug. The shield itself is a wide plate, the sides of which when in place extend up to and a trifle beyond the wings of the nose, while the top almost touches the tip of the nose. It is held in place by means of an elastic band attached to the lip plate and passing around the head. Directly underneath the nares the shield is deeply curved to permit the passage of the air. It can be adjusted readily to throw the exhalations of the patient's breath to the right or left, and is worn without discomfort to the patient.]

Dr. A. E. Matteson: This little appliance which I have here was made for a case in actual practice—that of a boy twelve years of age, who, in falling, struck his front teeth in such a manner as to knock out the left central and lateral incisors, also fracturing the labial process to a considerable extent. There was great difficulty in bringing the fractured process into position, but it was accomplished.

The teeth were washed in a weak solution of carbolic acid; pulps extracted and canals filled; the teeth replaced and an impression taken, and a cast made, upon which this little splint of gold and platinum plate was struck up. This was then cemented to the injured teeth, together with the two teeth on each side. The splint covering not to exceed one-third of the crowns did not interfere with the thorough cleansing of the parts. Nothing further was done with the fractured process. The boy ate his meals regularly and without the least difficulty, and the next week started on a trip up the St. Lawrence, and was gone a month. The splint was removed after his return, having been on nearly six weeks. I present this, as I have never seen anything brought forward so simple that would accomplish as satisfactory results.

I was assisted very materially by Dr. Frank H. Gardiner, of Chicago, in filling the roots of the teeth.

Dr. Kulp: The crown known as the Büttner crown I consider in advance of anything I have ever seen, where there is a sound root, but in cases where the roots are funnel-shaped it is not applicable. I hold in my hand a crown that is mounted on the root by cutting the inside instead of the outside of theroot, in the same manner as the Büttner crown is used. The instruments are of different sizes, made by number, and the tap made to correspond with the size of the instrument. The crown end of the root is cut convex, and the tap fits exactly in the root, so that the cap covers every part of the convex end of it. The pin, or tap, is of metal, and will bear any amount of heat; at the same time it is soft enough to be bent, if necessary. The impression being taken, with pin and cap in place, the crown is then put on in the usual way. In placing the finished crown on permanently, a very little cement is used on the pin and in the cap; the end of the root is thus entirely covered, and everything is perfectly tight and clean. I have never had so much satisfaction with any crown as I have had with this, and my patients have never experienced so much satisfaction with any other method. The invention is that of Dr. J. E. Low, of Chicago, and it is called Low's crown.

Dr. E. Parmly Brown: There are two objections that I would urge to the crown that Dr. Kulp has shown us here: First, the process of reaming out so much of the tooth, especially in cases of small teeth where the tooth-substance is soft, must greatly weaken the root. The other objection is that impressions, and all that sort of thing, are necessary. I have been making about twenty different styles of crowns, some of which I abandoned because they were too complicated to get manufactured. I now have to present one which I have just perfected in connection with the bridge-work. You know that the Logan crown has part of the tooth hollowed out for the fastening material to penetrate the porcelain of the tooth around the pin; that necessarily weakens the porcelain at that point. The Logan pin is equal in strength in every direction. You know that the strain on porcelain crowns is not equal. In this crown of mine the pin is flattened, broader in one way by nearly double; this makes it strongest in the direction where the strain is greatest. In this crown, instead of hollowing out the porcelain around the pin, we add more porcelain than is already made in the tooth, letting the porcelain run up into the root on the pin. What is gained by this? To take a tooth of my new design, as I have drawn it on the blackboard and described it, and get it ready to put in the mouth, the same as seen in the box of specimens, and then grind it out at the point where the leverage is greatest—at the neck, around the pin—making a Logan crown of it, would be entirely against all principles of mechanics, *i. e.*, it would be taking a strong tooth and making it a weak one.

Dr. Kulp: The objection to this idea of crowning is evident to any one. The root is cut out from the center, leaving no support to the edge whatever; and this is the serious objection I have had to almost all crowns. The method I have shown does away with that. It bevels the edge of the root and the cap comes over it. The instruments are of different sizes, as small as the canal in the lateral incisor; so there is no cutting away of the tooth more than there would be in applying any other crown. The upper part of the root-canal is not enlarged, and this concave cap that receives the convex end of the root prevents any possibility of splitting or ingress of moisture or secretions. This method is also applicable to molars and bicuspids. The form of the cap need only be flattened, and, if need be, can be extended with platinum plate, so as to cover the entire root. Then, after the tooth has been ground into place, it must be backed and soldered to the cap, and put in place with cement as before stated.

Dr. Stockton: Crowns and bridge-work constitute the most important branch of practice engaging our attention at this time. I wish to report a case I have lately had in hand. Please observe the condition of the mouth. The upper jaw contained the six front teeth and the two twelfth-year molars. The lower jaw contained the six front teeth, one bicuspid, and the two wisdom-teeth. The condition was such that no two teeth occluded. When the jaws were closed, the upper front teeth were hidden from view by the lower front ones, and the appearance was very unsightly. Two or three attempts had been made to remedy the defect by artificial dentures, but they were not successful. When bridge-work came the remedy was supplied. The operation was completed by capping the teeth adjoining the vacant spaces, and filling the spaces with the ordinary bridge-work, and lengthening the bite to its normal condition. My patient is a preacher, and is delighted with the work, as it enables him to masticate his food thoroughly and articulate much more distinctly. His appearance is greatly improved. I say, therefore, that bridge-work, properly made and adjusted, is a great blessing, and we should make ourselves familiar with its construction.

Dr. E. Parmly Brown: I have a word to say in regard to the Herbst method of filling teeth. That method may be very good for Germany, where Herbst is practicing. No doubt it is good; but is it the best? Not by any means. What does it do? It renders necessary the extensive excavation of a great deal of sound dentine towards the pulp, and leaves the weak walls to hold the soft mass of filling in. To-day good operators take away hardly any of the sound dentine, but they do cut away all the edges of the enamel that are defective. As cavities were prepared by Marshall H. Webb, no filling of that kind could be inserted in them. Did Webb prepare cavities properly? Is there a man here that dare say he did not? His fame extends not only throughout this country but is world-wide.

Dr. Patterson: Practical experience and demonstration only will prove this system, and for that reason do I rise to give you my experience. When it was first brought to the attention of the profession, I procured instruments, and made a great many experiments in the laboratory and a few fillings in the mouth for friends of mine, and after this lapse of time my observation of some of the operations convinces me that this method is unreliable. There are certain classes of cases only that admit of filling by the Herbst method, and even in these cases the work can be performed more

rapidly and more durably with cylinders and the usual methods. It cannot be used for contour work. In my judgment, based on my experience, the operations which were performed here yesterday by the Herbst method will in six months' time prove to be failures.

Dr. Daboll: The principal reason for my liking of the Herbst method is that I approve of its forms of matrices. For twenty years I have been in the habit of using Jack's matrices. I think I can say, without detriment to my reputation, that no man can fill a tooth with gold or with amalgam with the ease and certainty by any other method that he can by the aid of a matrix. With this properly adjusted, every compound operation and every complex operation is simplified. It converts all such cavities into simple crown cavities. Of course, the matrix is not necessary to the filling of front teeth, and I do not advocate it for that; but in the bicuspids and the molars I never fill the proximal cavities, either with amalgam or gold, without it. I want to say to the young men who are here that the study of the matrix will demonstrate its value in these operations, and its use will save them many lamentable failures.

Dr. W. A. Spaulding: I have been amused somewhat by the remarks of gentlemen who confine themselves to one idea, or to one method; for instance, the Herbst method of filling teeth with gold. It may answer in some places and in some cavities, but as has been said, it is unreliable. It may be used in crown cavities that are large enough to permit of the proper manipulations. If we confine ourselves to any one idea, we shall be apt at times to fail; but if we have many methods at our command, and use such as are clearly indicated for the case in hand, we shall attain a larger measure of success. The gentleman who last spoke said he always uses matrices for filling either with gold or amalgam. I find many cases in which I cannot use matrices, and I find cases where I can use them with great advantage. We should exercise thought and ingenuity, and make use of our own methods, instead of confining ourselves to Brown's or Smith's or any one's method.

Dr. Barrett: The methods of filling teeth with gold may be simplified and reduced to three. There was the old style of forty years ago, in which soft gold was universally employed, and the tooth was filled upon the principle of wedging. That principle cannot be employed except by using gold that is non-cohesive. Teeth filled in that way have been preserved as perfectly as by any other method ever employed, but it could not be used for contour opera-

tions. Succeeding that came the use of cohesive gold, which naturally carried with it the idea of an impact or blow, and necessitated anchoring-points, and the building up of the filling from those, piece by piece, until the entire contour of the tooth was restored. The principles employed were entirely different, one being founded upon the fact that the surfaces of the gold would slide upon each other, and the other that they would not, but would cohere; and it can readily be comprehended that for the successful filling of teeth by either of these methods a strict and consistent system must be followed.

The Herbst method is still a third new and entirely different method, and it produces different results. It is not, in my estimation, adapted to the restoration of contour any more than the old soft-gold style of filling teeth. In all the different systems you will find something lacking, but each one will have its particular advantages, and there is such a feature in the Herbst method. If you have a comparatively smooth and level surface, and you desire to place in absolute contact with it a piece of gold, how will you do it? By impacts, by pounding upon it with small, sharp points? No; if you wish a piece of foil to be in absolute contact throughout with a smooth surface, you will not pound it. You will take something smooth, and burnish and polish it down, one piece upon another, and that is the principle upon which the Herbst method of filling teeth is founded. To produce absolute contact of two surfaces they are not to be pounded with a sharp point, but the two surfaces should be rubbed together. When you wish to make gold cohere, then the impact is best; but if you wish to bring two surfaces in absolute contact, the rubbing system of the Herbst method is best. I believe that by it it is possible to produce the most absolute contact of the gold with the walls of the tooth, and I believe it can be done by no other system as well. If any person desires to be a complete operator, he must have command of all the different systems of filling teeth, and he should use for the case in hand that which is best adapted. If he has a cavity with three walls, upon which it is difficult to produce adaptation, let him insert the matrix and use the Herbst system, and when he has got near the surface of the filling, where he wants a hard surface for masticatory purposes, let him use the mallet.

Dr. E. Parmly Brown: I would say that wherever gold is needed in the human tooth, it is needed there absolutely solid. If there is a place, unless very small, where gold can be otherwise than

solid, then gold is not needed there. Oxyphosphates, or other materials, can be put there to better advantage, as they act as non-conductors. I do not believe the Herbst method will put gold into any angle or any pit, and I have challenged Dr. Herbst, or any of his disciples, through the dental journals, to meet me, in Europe or America, and have several days' contest of the comparative merits of the two systems, two dentists' mouths to be selected upon which to operate, and we will toss up a penny for the choice; but I have had no answer from them, except to invite me to fill glass tubes. The Herbst method is rotary, and the glass tube is cylindrical, and of course they can roll the gold up around the inside of a glass tube better than by pounding it there; but glass tubes are not human teeth, and there is no comparison whatever between them.

Dr. M. L. Rhein: Dr. Barrett, in his remarks, struck the key-note of this subject. One gentleman spoke about having used the Herbst method for a number of years. I have merely this to say: We have found it impossible to use the Herbst method properly without a peculiar kind of gold. That is one of the secrets of the method; and this gold had not been in this country until Dr. Bödecker brought it over last summer, so that the gentleman certainly never could have used any of it. It is the same gold which led to the improvement in manufacturing during the last few months by The S. S. White Dental Manufacturing Co., and also by Mr. Williams. The Wolrab gold is, beyond question, the softest form of gold ever introduced to the profession. It is soft and non-cohesive in the bulk; and when it is burnished around in the tooth it becomes as cohesive and perfect a weld as if it had been malleted. In the clinic I gave yesterday, although laboring under great disadvantages, I trust I was able to demonstrate the thorough welding of the gold by the Herbst method. None of it was annealed; and before it was malleted it was thoroughly examined by a number of dentists, in regard to the question of its thorough cohesiveness after burnishing, and I believe the point was undisputed. I am quite certain this method cannot be used with the ordinary forms of gold. I inserted some very extensive contour fillings in this manner last September, which, when seen only a week or two ago, were found in as perfect a condition as any contour work put in by the use of the electric mallet.

In reference to Dr. Brown's strictures on this method: There is no difference in the preparation of the cavities, except that we need no retaining-point and no narrow undercut, and that is one of the advantages of the Herbst method. The whole secret of mastering

this system lies in the proper use of the matrices. Dr. Herbst has given much attention to this, and has shown much ingenuity, especially in the adaptation of the matrix to the anterior teeth. It is just as necessary to have a strong enamel in this method as it is where the electric mallet is used; and I want to reiterate what I said yesterday, that I believe that the conclusion of the operation should be made with the mallet. Dr. Brown stated that where we did not need solid gold oxyphosphate would answer. That is very true for a very deep cavity; and in the Herbst method, where there is any such depth, we also use oxyphosphate; but where a cavity extends from an eighth to a sixteenth of an inch below the gum, we must have a certain amount of space, and we cannot take up too much of that space with oxyphosphate or any other soft filling. Now, the great remaining objection is that you cannot insert as much gold in the cavity. Is this a valid objection? Certainly a large proportion of the profession do not admit it. When the enamel edges are hermetically sealed, and all possibility of leakage is absent, our aim is accomplished. It matters not if there are two or three grains of gold less in the interior that we could insert with the mallet. Aye; there is often a question whether a tooth (in a not over-healthy condition) does not suffer from being packed too solidly with gold.

Dr. W. A. Spaulding: I understand the Herbst method to be simply the introduction of a new kind of gold that is said to be the only pure gold made. I supposed the method was intended for the use of all kinds of gold, but the gentleman just said it can only be done by the one kind of gold, such as he has used to-day.

I am now using Hood & Reynolds's gold, and find it very soft and easily worked. I can burnish it to the walls of a cavity with hand-pressure, and build upon it as I wish without annealing; and when the filling is nearly completed, burnishing another piece, annealed, down upon that, I find them to be firmly coherent. Therefore, Hood & Reynolds's gold can be used in that manner; and I doubt not that any gold that is used by any member of the profession may be used in a manner to consolidate and cohere it firmly to the walls of the cavity. I think when we confine ourselves to one particular kind of gold, for the purpose of introducing a new method, we are becoming very narrow.

Dr. Ingersoll: It appears to me that two or three principles have been developed in this discussion which have not been taken into the account. When two surfaces are brought into contact they are held

in contact by atmospheric pressure. Take two pieces of glass and moisten their surfaces, bring them together perfectly, and they cannot be easily separated. There is no cohesion between the two pieces of glass, nor any adhesion, from the fact that the intervening fluid is not adhesive. How are the two pieces of glass held in contact? By atmospheric pressure. That principle seems to me to explain what Dr. Barrett said of burnishing one surface of gold firmly upon the other; if he absolutely excludes the atmosphere, the two pieces of gold are held in contact by atmospheric pressure. I doubt if we have any such system as filling teeth by atmospheric pressure. Another principle is the development of electric attraction. Dr. Herbst says he *does* do contour work. Dr. Rhein, of New York, says he has done it. There are those who say it cannot be done. Are there not two different principles in the minds of men making these contrary statements? and are they not both absolutely right in what they say? It has been said in regard to the Herbst method that when the instrument is first applied it slides smoothly over the gold. Very soon the gold begins to adhere to the instrument. What is the cause of the adhesion? Electric attraction, induced by the friction of the instrument. That may explain the fact that the contour filling can be built up even without cohesive gold. Cohesion of the gold is developed by electric attraction.

Dr. Atkinson: I have been using, for nearly three years, a gold made upon platinum and iridium. This form of gold is prepared by Ed. Rowan & Co. and R. S. Williams, of New York. Its advantages are that it makes a harder surface to chew upon, and wears better than any that I have ever seen, and it works very well. I have used it as heavy as 120, but I prefer 60. You can use it down as low as 30. You can fold it backward and make it perfectly tight, and it more nearly approaches the color of the tooth. It is principally in consequence of its hardness and its cohesion and resistance to impact that it is so desirable for grinding and cutting surfaces.

Dr. Morgan: Does it cohere to ordinary gold?

Dr. Atkinson: Beautifully.

Dr. Darby: Do you use 120 and 240 gold generally, in all cavities, or only for the surface?

Dr. Atkinson: The lowest number of gold that I use is 30. My uniform common use is 60 and 120. Where I have very small cavities in very strong teeth I am not particular, whatever comes to hand, 240 or 480. Cut the strip of the breadth of the cavity, and take three or four thicknesses of that, anneal it, and carry it home.

Dr. Allport: When I listened to the remarks upon the use of gold and the different methods of operating, I was reminded of what a noted divine said, that "there was no heresy so false that it had not a germ of truth in it;" and I may add, there is is no doctrine so true that has not its falsehood in it. There is nothing truer than that in the practice of dentistry, and especially in this department. One speaker will insist upon the absolute hardness and solidity of a filling as being the greatest essential in saving teeth. Fillings sufficiently hard to resist the friction of mastication are indispensable to good operations, but when you go beyond that point you go beyond the point of utility, and the hardness becomes an absolute injury, from the increase of the conductivity of thermal changes that pass through to the dentine of the tooth causing irritation. Therefore I am no stickler for hard fillings.

In Boston I made the remark, and I believe it was the first time it was made, that the essential difference between cohesive and non-cohesive gold, and the great advantage of non-cohesive over cohesive in filling, was the simple and only fact that the surfaces of non-cohesive gold would slide upon one another, thus preventing clogging as in the use of cohesive gold. I don't believe there is a man here who will have the assurance to stand up and say that any man has ever lived who has saved more teeth not requiring contour fillings than were saved by the old-fashioned practitioners by the use of non-cohesive gold. Yet there are those so prejudiced against it that they will not use it; they eschew a good thing, and adopt something that has more evil in it. More beautiful operations in crown fillings than were put in by some of our old operators no one ever saw, and they were not cohesive. In filling a cavity you want a material that will most easily spread and yield under your instrument; therefore, there is nothing for filling a cavity better than non-cohesive gold. That is why the Herbst method may be good; it is not so much Herbst's *method* as Wolrab's *gold* that is good. When we come to building up a tooth, then comes in the great advantage of cohesive gold. Last year I suggested that while the Herbst method possessed some advantages, or rather that while "it had sufficient good in it to induce some to adopt it, it also had sufficient evil in it, that if it was generally adopted, it would cause much disappointment, and result in a great deal of mischief." Very few believed it. There was a certain furor for it. It was like some meteor sweeping through the sky that attracted everybody's attention. I said then, and I wish to emphasize what I said, that in my

opinion, while in many cases it might be good, for very much practical work it is very nearly worthless. I had had no experience with it. I expressed my opinion from what I had heard. From what I have since seen I am confirmed in my former opinion. That this gold may be burnished against the walls of a cavity nobody with any sense will dispute, but how on earth are you going to take straight instruments and fill in undercuts? You may do it to some extent, but if you use straight instruments, as you are obliged to, how are you going to use a straight instrument to pack gold into undercut cavities? The only way you can do it is by cutting away and destroying that which no man has a right to destroy when it can be saved. Therefore I say that, while the gold is good, the method of using it has so much against it that whoever undertakes to use it in his practice generally will certainly in a very few years have the reputation of being a poor dentist. I give that as my opinion for what it is worth.

Dr. Thomas: It was said that all roads lead to Rome. We are all striving to attain the same end, but clearly by different roads; and some of those roads are hard and some are easy; some are strewn with thorns and some with thistles, and some are made easy by the methods we adopt. Any man who ties himself to any one particular method of filling teeth is a slave to his own contracted ideas, and his patients will suffer for the want of good, valuable service. There is a great difference between a man being able to make a beautiful filling and being a good dentist. There are a great many men who can make beautiful operations, that the eye will be pleased to see and that will be commended by the laity, and yet who may be very poor dentists. I, for one, believe that there is danger of carrying the use of cohesive gold too far. If a man can produce as good results with non-cohesive foil as he can by using cohesive with the electric mallet, or any other mallet, it is due to his patient that he should do it. We must not forget that we are operating upon frail structures that often suffer by over-operating upon them; and I believe, at the present time, that there is more danger from over-operating than from not operating enough.

Dr. Daboll, and all men who have used the matrix as much as he, can use it with great advantage to themselves and their patients. He advises young men to adopt the use of the matrix. So do I, after they have learned to produce good results without it. Learn first to make a good gold filling without the matrix, and then the matrix will be of great advantage to you and your patients; but if

a man attempts to use the matrix first, before he is aware of it he is leaving ground uncovered that will give him and his patients a great deal of trouble in the future.

Dr. McKellops: I have listened to my friend Allport, and I have listened to my friend Thomas, and I will ask my friend, Dr. Allport, what he calls cohesive foil and non-cohesive foil, and what he uses a lamp for, and what he uses a mallet for? I have seen the gentleman operate when he was telling me he was using soft foil, when he would take No. 4 foil, roll it in his fingers, and cut it off and stick one end in the lamp and say, "I only did that to get the point to stick." You all know that the moment the foil comes in contact with the flame it becomes cohesive. And his assistant stands by with the mallet. I would like him to practice what he preaches.

My friend Thomas speaks about the matrix. There is not an instrument that is more useful than that little matrix that was brought out by Dr. Jack, of Philadelphia. The use of that instrument ought to be the first thing taught to every young man in the profession. In filling proximal cavities in bicuspids and molars it is essential, where you want to save time and insure perfect work. You cannot get up to the cervical wall and do the beautiful work that is necessary unless you have that instrument in place, and you want to teach the young men to put it in place, and then they will accomplish perfect results.

I have tried all kinds of gold, and all manners of filling. My friend Dr. Atkinson refers to the iridium gold. A gentleman from Albany sent me some iridium gold foil, but I found it not pleasant to work. I have not had the experience with it that I have had with platinum gold. Afterwards, Mr. Rowan sent me some. I could not work it. I found it too stiff. I don't think there is any material that we use that we get better results from for masticating purposes than platinum gold No. 60. There is nothing that gives me such satisfaction. It was first brought to my notice by Dr. C. E. Blake, Sr., of San Francisco, California, in 1876, and I have been a constant worker of that material ever since, and I can produce almost any shade of gold with it that is wanted in restoring the contour of front teeth. I find none that gives me so much satisfaction as that manufactured by Williams, of New York; and when it is carefully manipulated, you could hardly tell across the table that the front teeth had been filled.

Dr. Abbott: As is illustrated in the *Independent Practitioner* for this month, I invented a set of instruments for the purpose of

overcoming the objection made by Dr. Allport, "that it was impossible to get into certain cavities with a straight instrument." A straight instrument to operate about the mouth with is an abomination. With these instruments all can easily be done that can be with straight ones, and many things that cannot be done with them. I filled one tooth by means of the Herbst method, which I am sorry to say failed utterly in less than three weeks. My fault was in not doing the work in exactly the manner Dr. Herbst does himself. He uses a rough instrument instead of a polished one as I did, which leaves the gold surface in a condition to cohere to the pieces of fresh gold when applied forcibly to it.

Nothing has been said with regard to the bridge-work of Dr. Brown's. I was so well pleased with the specimen that I saw in his hands, and the work that I saw in a gentleman's mouth here, that I feel like saying that in my judgment it is the finest in the way of bridge-work now in use. It admits of being adapted directly to the gum so perfectly that no irritation is produced at all. It enables us to have a perfectly shaped tooth, so that the tongue comes in contact with a tooth instead of a flat surface of gold, which in many instances would be of great advantage in speaking.

Dr. Morgan: There was a point in connection with the application of artificial crowns upon the roots of teeth that was merely alluded to by Dr. Brown that I wish to emphasize, and that is, the medication and treatment of the root preparatory to mounting the crown. It is one of the most important matters to be attended to in restoring teeth by artificial crowns. Unless you get the root in a comparatively healthy condition, your patient will have very serious trouble, and often your operation will be a failure. I sometimes see operations where the crown of a pulpless tooth has been taken off, the crown mounted, and the work completed at a single sitting, without the root ever having been treated or the canals filled. In a large number of such cases there will be serious trouble.

Another point to which I desire to call especial attention is the method in which many of our brethren prepare their gold, so that it takes ten times as much force to bring the surfaces in contact as would be necessary provided it had been properly prepared. Every angle that you make in your gold foil requires a certain force to break it down. So a hundred angles in a pellet would necessitate great pressure to flatten it out and bring the surfaces in contact.

Some one said a filling to approach perfection should be perfectly solid. I am sure that friend is mistaken. There are cases where

compactness throughout the entire body would be a disadvantage, first, because of its greater conducting power, and, in the next place, because of its expansion under the influence of heat.

I don't know whether I understood my friend, Dr. Allport, when he said there was no man here who would have the assurance to say that we could save more teeth with cohesive gold than we did originally with non-cohesive.

Dr. Allport: I said simple cavities within the teeth.

Dr. Morgan: With that explanation I would like to say yea, but without that I would say that we save teeth by the hundred every year by the use of cohesive gold, where our fathers put the forceps on. That is the truth upon that point.

I am in favor of the use of matrices, and use them sometimes. I have found them in certain localities of great assistance; but stress was laid on the point that it made all cavities simple cavities, and therefore they were to be used. Sometimes the making of a cavity a simple cavity increases the difficulty of filling it. Some compound cavities are more readily filled, and can be better filled than if they were simple. Picture in your mind a mouth where there is considerable convexity on the surface of the upper teeth, with compound proximal cavities in the second and third molars. Attempt to put on your matrix and undertake to fill those teeth. You have to get around behind your matrix in order to accomplish it, whereas, if you leave your matrices off you can see what you are doing, from the cervical wall until you finish it.

Dr. Allport: Dr. McKellops says that I anneal my gold, and therefore my gold is cohesive, and because I use a mallet I must use cohesive gold. In the first place I do anneal my pellets, but only just a little bit of the extreme point (my pellets being made oblong); that is all. In the second place I do use a mallet, because I can use non-cohesive gold better with a mallet than with hand-pressure. Many do not believe that.

In regard to my method of using non-cohesive gold, I want to explain. Suppose I make a retaining-point, which everybody does when they use cohesive gold. I say no man can fill that retaining-point, or any other cavity, as perfectly with cohesive gold as he can with non-cohesive gold. What do I do? Above all things, that is the point that should be well filled if I have one. I take a small pellet in the pliers and anneal a little end, as the gentleman says; then I put the non-cohesive part into my retaining-point. I fill my retaining-point perfectly with my non-cohesive gold, and I leave a little of

it, perhaps the size of a pin-head, cohesive. I then take my next piece of non-cohesive gold, and will perhaps anneal that in the same way. I put my non-cohesive point on to the cohesive point and get cohesion every time. What is the advantage? It is said you cannot make non-cohesive gold stick. Each one of the annealed points becomes a retaining-point, and I have no trouble with my gold tumbling off or rolling about in the cavity.

Dr. Kulp: Some years ago I had the misfortune to lose a first molar, bicuspid, and cuspid on the left side in the upper jaw. In that place I wore as many as twenty different kinds of plates made by different persons to supply the deficiency, the teeth on the other side being in good condition. Later on, I had the misfortune to lose a lower molar on the opposite side. Then my dilemma began. I found it impossible to masticate on the artificial appliances on the left side above, and, furthermore, the molars began to abrade, and my front teeth began to push forward and became sore. One of them was pushed out of the arch considerably, and began to abrade on the lingual side. I had heard a good deal about bridge-work, and had had my attention called to the advertisements of bridge-work; I concluded I would "beard the lion in his den," and called upon Dr. J. E. Low, of Chicago, to see what could be done for me. I had the bicuspid and molar remaining capped, and an artificial tooth attached to each of the caps to supply the place of the lower molar lost. This separated my front teeth considerably. On the other side I had the same done to the molar and bicuspid, and a cuspid and molar attached to the caps. This restored my power of mastication from my cuspids back on both sides, and kept the front teeth apart. I have worn this work for nearly two years, and it has given me very great satisfaction. I have no difficulty in keeping it clean, and I have not a particle of sensation in the teeth that are capped. I think I am perfectly restored; and do not wear a plate. I have since put in quite a number of bridges for my patients, and so far gratified them to a much greater degree than with any other method of inserting artificial teeth in all my years' of practice.

Dr. Patrick: I hold it to be the first duty of a dentist to know the chemical as well as all other properties of the material he employs in his profession. If he does not he is a mere artisan and cannot be entitled to the rank of a professional man. We have heard the terms cohesive and non-cohesive, adhesive and non-adhesive, applied to express certain properties in gold, used in a manner that would indicate some confusion of terms in the minds of some of the

speakers. There is a great variety of commercial names attached to gold prepared for the dentists' use by the manufacturers, which do not indicate any property contained in gold. For instance, the word adhesive is not applicable to the unity of the molecules of two portions of gold, or any other two portions of a solid when brought in contact, for adhesion is a force which unites the particles of *different substances;* thus it is the force of adhesion which causes two plates of lead and tin to remain together after being subjected to pressure. The substances used as cement present various gradations of adhesive power, and are selected to suit the circumstances, —calcareous matter to unite stone and brick, resinous materials for glass and pottery, and glue for wood. Gold possesses the molecular force that *unites the particles of the same kind of matter* in an eminent degree, and is, therefore, very *cohesive*, and consequently not adhesive. The working properties of gold may be modified, as in the degrees of hardness or softness, for when gold is rolled or beaten its particles are driven together, presenting that property called hardness or compactness in the metal. Again, by the application of heat the cohesion of its particles may be partially overcome, giving it the property of softness. Now, in the degrees of softness it might be called cohesive, because in this condition its particles would more readily cohere under percussion or pressure, but in degrees of hardness, its particles presenting more resistance to percussion than in a soft condition, it might, in a relative sense, be called non-cohesive.

There has been a great deal said, both here and elsewhere, in regard to the different methods of filling teeth. I am not going to promulgate a new system, for, to my mind, the difference between the many methods advocated for handling gold is about the difference between tweedledum and tweedledee. Nevertheless, the time occupied in discussing the different methods of using gold is not altogether lost, even if it only serves the purpose of a badly constructed building, which always suggests to the mind the necessity of constructing a better one. In this connection, I wish to say a few words in regard to the Herbst method, a method that has recently attracted much attention. It is a system of burnishing one layer of gold upon another, and I cannot see how the cohesive properties of gold can be secured as well by this method as by a serrate-pointed instrument which, when struck at one end, gives the true impact of the blow at its serrated point. I understand that the Herbst burnishers have been modified by grooving. This would impart a blow to the gold when they were rotated, and experience has shown that a

grooved burnisher will beat down the serrated surface of gold. But the molecules of gold cannot be driven together so as to make them cohere with that force which is obtained by direct concussion.

Dr. Dyer: There seems to be a misapprehension of the terms adhesive and cohesive. Gold is all cohesive if it is absolutely pure and there are no foreign substances upon its surface. We pass it through the lamp to remove foreign substances from the surface. That returns it to its natural cohesive state. Adhesion is the union between like or unlike substances in mass. Cohesion means the uniting of two like particles. You bring two particles or molecules of gold together and they unite. We only use force for the sake of bringing them together. Cohesive gold is pure gold in its natural state and is very soft. Cohesive and soft gold are spoken of as though they were opposed in character, while in fact so-called soft gold is not apt to be as soft as the cohesive after it has been passed through the lamp.

Dr. Ames: I am very much in favor of eclecticism in dental practice, but I can hardly commend the combination of the Herbst method and the force of the electric or other mallet. I cannot see the consistency of putting gold into the bottom of a cavity by a method which the gentlemen admit does not condense it thoroughly, and then using the electric or other mallet to condense the last parts. But, by the use of non-cohesive cylinders with hand or mallet force, a foundation can be built sufficiently firm to withstand the use of cohesive gold with the electric or other mallet at the finish. What objection is there to malleting upon non-cohesive gold, and where should we use mallet force and where should we not? I claim that, when endeavoring to pack gold into any inaccessible part of the cavity, *i.e.*, a part that cannot be brought into direct line with the axis of the packing instrument, the mallet should be laid aside and hand-pressure employed. If it is a foreign substance upon the surface of the gold that renders it non-cohesive, I do not think it can be detrimental so long as it causes the slipping of one layer upon another.

Dr. Taft: In 1881, at the International Congress in London, there were specimens of fillings exhibited by Dr. Blount, which were accomplished in very nearly the same manner as those made by the Herbst method. Smooth-pointed instruments were used, and the same principle essentially was involved except the rotary movement of the instrument. The cavities were lined with non-cohesive gold, the central portion being filled with cohesive. This lining was very

perfectly done, and was the admiration of every one who saw it. The advantage claimed for that method was the thorough adaptation of the gold to the walls of the cavity everywhere. That this would be accomplished better by this method than by almost any other, I think no one would doubt after seeing the specimens and witnessing the operation. The method was a very easy one, and it seems to me to possess some advantages over almost any other. I do not know that it has been adopted in general practice by any one else than Dr. Blount, and perhaps two or three whom he has specially directed in the matter. I simply refer to it because it has not been referred to here, and it embraces very nearly the same principle involved in the Herbst method.

I wish to refer to a statement made by one gentleman in regard to the use of the matrix. Dr. Daboll suggested that all young men should study the matrix well, and implied, if he did not directly say so, that every one should use the matrix in almost every case of proximal filling. I do not regard that as good advice to young men. It should be taken with considerable caution, to say the least. It is said that when the matrix is placed upon a tooth with a proximal cavity you have reduced that cavity to a simple crown cavity. There are particular points to be observed in filling a cavity of this kind, when the matrix is used, that are not presented in simple crown cavities. The adaptation of the gold to the cervical walls of the cavity, as well as to the lateral borders, is almost impossible of accomplishment when the matrix comes up close and square against the cervical margin. There will be imperfect work unless very fine instruments are used for condensation at that point, and skillfully used too. That is a point that will not be secured without more skill than is ordinarily used, or than is possessed by a great many in the profession. I would not advise a student to use the matrix in any case where he can readily fill without it.

Dr. Brophy: I wish I had some gold here and some ammonia so that I might show the gentlemen how cohesive gold might easily be made non-cohesive. This I learned from Prof. Black, of Jacksonville. Cohesive gold subjected to the fumes of ammonia readily becomes non-cohesive. This is owing to the presence upon the surface of the gold of the ammonia. It is immaterial to me whether I buy non-cohesive or cohesive gold. If I want it cohesive I anneal it; if I want it non-cohesive I put it in a drawer in which I have placed some ammonia. All the difference between non-cohesive and cohesive gold is, that the non-cohesive has something upon its sur-

face which prevents the molecules of gold from uniting with each other. The cohesive has nothing upon its surface, and therefore readily unites with other cohesive gold.

I desire to say a word about bridge-work. While I have not myself had very much experience in constructing it, I have been a close observer of the work that has been constructed by others, and while it is most desirable to place something in the mouth capable of performing the functions of mastication without the use of the plate, I regret to say that what I have seen is anything but satisfactory. It is true it may be used where one or two teeth are to be replaced, and may serve a very good purpose for a considerable length of time; but should any one place in four or five or even three teeth, we will say the first molar, bicuspid, and cuspid, it will soon result in failure. I would like to have some gentleman tell me how he can secure an absolute adaptation of bands to teeth that lean towards each other. There will be a space at the bottom in which secretions will accumulate, and which will result eventually in the destruction of the teeth. Individually I would much rather do without one or two teeth on one side than subject myself to the inconvenience of wearing an appliance of this kind, unless there can be some way invented which will make it more cleanly than any I have seen up to the present time. Why not put in a little gold plate that will not injure the teeth and which will serve a far better purpose. Wherever the bridge is inserted in the mouth it means that the individual has an appliance that will enable him to masticate and incise his food, but the destruction of the teeth to which this bridge is attached will sooner or later result.

Dr. Horton: Dr. Allport said, if I understood him correctly, that the old method of filling saved as large a proportion of teeth as are saved at present, considering the number filled. I understand him to mean by the term "old method" that pertaining to the use of gold, as the various methods of using gold seem to have been especially referred to by those who have spoken upon the subject. In the main what he said may be true; but I think careful reflection upon the subject will convince him, as well as others, that he is far short of the whole truth in his computation. The manufacture and introduction of what is known as "cohesive foil" opened up a field of wide possibilities; and I venture the assertion that thousands of teeth are now saved and made useful where one was by the old method. Teeth are now saved by the same dentists who, twenty-five or thirty years ago, would unhesitatingly have applied the forceps and an artificial substitute.

We are an imitative race. So, when the beautiful contour fillings made by Dwinelle and a few others made their appearance, every dentist possessed of the ambition to be regarded in the front rank of the profession exerted himself to produce the same result. Progress was the outcome, until what at that time was regarded by many as an impossible attainment, or if attained of but little practical utility, is at the present time successfully performed by hundreds, I may say thousands, every day. And, now, another method has been introduced similar to the one just explained by Dr. Taft known as the Blount method. I refer to the Herbst method, of which much has been said in the journals and elsewhere, and a full explanation of which has been given us during the consideration of this subject. I am of the opinion, although it is but a guess, that Herbst obtained the suggestion for his method from Dr. Blount; and here I would say that Prof. Taft, in his explanation of the Blount method, omitted to state that Dr. Blount gave the instrument a rotary motion to convey the gold to the walls of the cavity. While he (Blount) used hand instruments and non-cohesive foil, Herbst uses the engine and non-cohesive foil; and I have no doubt that both have produced results highly satisfactory to themselves. The truth is, every dentist who makes operative dentistry the main feature of his practice should be pretty thoroughly posted in all these methods, in order that, while he has peculiar ways of his own in performing operations, he may be able to avail himself of any useful ideas suggested by the others. I am not prepared to criticise the Herbst method at this time, though I think I can see some very pertinent objections to substituting it for the one I already have.

Dr. Thomas: I do not want to rest under the imputation that Dr. McKellops would try to fasten upon me, and I see he has gone out, for which I am sorry. He seemed to think that I was very unfortunate in not knowing the use of the mallet, which he designated as being the most valuable instrument that had ever been invented. I admit that it is one of the most valuable, and I wish to say to him and to those who heard me before, that I have nearly all the mallets in my office that have been invented, I think, and I know something of their uses, and when I can select my patients and cavities, I should use the mallet by all means. I only wish to say one word with reference to what the gentleman said about proximal fillings. He made the remark that such cavities could not be filled as well without the matrix as with it. I believe *he* made a great many good fillings before he knew there was such a thing as a matrix.

I wish to say one word in relation to Dr. Allport's method of filling retaining-points. If I understood him correctly, he said he took a pellet of gold and annealed one end, and turned it around and put the unannealed end in the pit. If I were making that operation I should reverse the order; and I want to understand why it is that we can depend upon the unannealed point in the pit and not in the cavity.

SECTION V.

Anatomy, Histology, and Microscopy.

Report by FRANK ABBOTT, Secretary.

MR. President: To my knowledge, there has been very little accomplished the past year in Histology or Microscopy bearing directly upon the teeth.

Of course, more or less has been done by those who advocate the septic theory as accounting for all kinds of pathological conditions to which human beings are subject to prove their position correct, and by those opposed to such theory to prove them incorrect. These latter "unbelievers" have made, it appears, several rather startling points, to say the least, which favor their position, viz.: M. Ducleaux has recently sent a communication to the Académie des Sciences on "The Germination of Plants in Soil Freed from Micro-Organisms." He chose for his experiments the Dutch pea and the haricot bean, the first of which has its cotyledon in the earth, the second on the surface. The soil having been sterilized before the seed was sown, germination did not take place. This soil was also covered with milk, but this was not altered. Thus it seems that it is essential to germination that there be micro-organisms in the earth. M. Pasteur, also, states that he "has found by experiment on animals that food which is free from micro-organisms cannot be digested, as they are necessary to the process of digestion."—*Journal of the American Medical Association.*

Comment upon the above seems unnecessary. It puts a *large organism* into the "thinking-cap" of every thoughtful dentist.

One step toward the more perfect illustration of the finer structure of tissues has been made (so I am informed upon the best of authority), which will prove of great service to all microscopists, viz.: Stricker, of Vienna, has invented a "micro-stereopticon" (this name is mine), by which an ordinary slide may be used, and the

"field" magnified to the enormous extent of 12,000 diameters, and projected upon a screen, so that a thousand people may study the tissue at the same time. The reticulum in the amœba and in the colorless blood-corpuscle is made so plain that no one can doubt its presence. Our theories in reference to the physiology and pathology of teeth are soon to be either established beyond a doubt or are to be disproved. What a relief this will be to the strained minds of some who are particularly interested in these questions! I expect within a few weeks to have the pleasure of seeing one of these instruments and witnessing its wonderful developments.

All I have to offer for Section V is a voluntary paper by Prof. L. C. Ingersoll, entitled "The Alveolo-Dental Membrane: Unity or Duality—Which?" and the result of some of my own work during the past year, which I present under the heading of "Studies of the Pathology of Enamel of Human Teeth."

SECTION V.—Continued.

Studies of the Pathology of Enamel of Human Teeth, with Special Reference to the Etiology of Caries.

Paper by FRANK ABBOTT, of the Section.

ONE of the most important questions in dentistry has always been the pathology and etiology of caries. Thoughtful dentists have long agreed that there is a marked difference, not only of individuals, but also of races, in the liability of teeth to decay. Quite recently a prominent dentist of New York directly accused civilization of being the most conspicuous factor in its production. It is an undeniable fact that, with advancing refinement of individuals and nations, decay of teeth is more prevalent. It seems to me, however, that even this recognized fact will not altogether explain the rapidly growing tendency toward this disease under all circumstances. It has many times occurred to me that there must be an anatomical substratum to fully explain the liability to caries in each single individual, aside from the acquired local causes to which caries has usually heretofore been attributed. Unquestionably, there are auxiliary agents in producing or fostering decay of teeth, such as certain kinds of food, more especially sweets, which are too often retained in the fissures always found in the grinding surfaces of certain teeth, upon irregular teeth, uneven surfaces of the enamel, etc. But all these cannot fully explain the fact that the simple change in modes of living should manifest itself in the sudden and rapid destruction of these organs. Strong, healthy individuals, upon being transferred from a country with comparatively simple habits of life into a country of high refinement, may soon become victims of caries of their teeth. Modern Germans and Irish, immigrating to America and enjoying luxuries (similar to those enjoyed by comparatively civilized old Egyptians, in whose mummies we observe, not without some surprise, a pronounced tendency toward decay of the teeth)

soon discover, to their great discomfort, at least, that their teeth are becoming diseased.

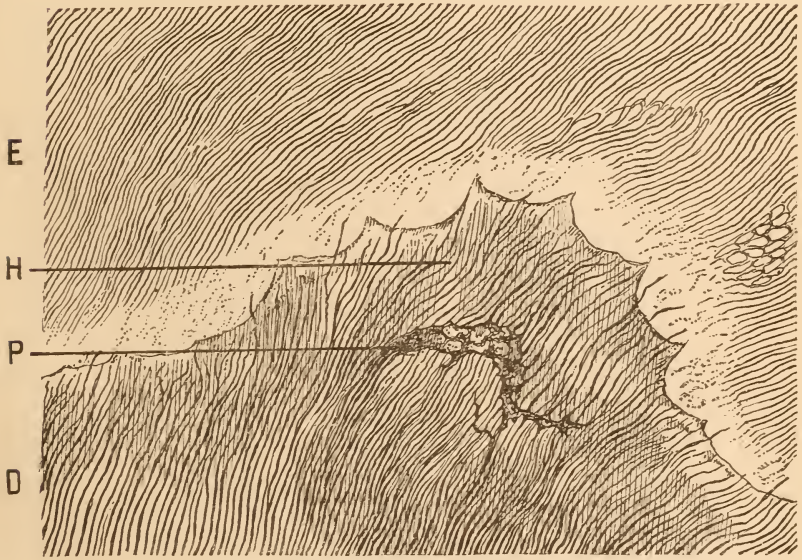
With these questions in mind, I undertook to examine a large number of teeth which had been ground into thin slabs, with the precaution of preserving their soft parts, especially their living matter, a method first introduced into microscopic technique by Dr. C. F. W. Bödecker. The results of my observations, though not exhaustive, are highly satisfactory, inasmuch as they explain, quite positively, the tendency of certain teeth to decay, the cause of which is in direct relation to and dependent upon imperfections in their anatomical structure. I claim, based upon these observations, that certain deficiencies in the minute structure of the enamel must be directly considered as playing a most important part in the etiology of caries.

Before entering upon the description of the anomalies of enamel which I have discovered, I wish to briefly recapitulate the description of the structure of this tissue, and its relation to dentine, as first discovered and published by Bödecker, in his essay entitled "The Distribution of Living Matter in Human Dentine, Cement, and Enamel." (*Dental Cosmos*, 1878–1879). According to this observer, the enamel is composed of rods and fibers of a slightly wavy course, interlacing between which delicate interstices are left. In these interstices run delicate fibers of living matter, sending minute offshoots in a prevailingly vertical direction into the enamel-rods, thus producing the cross-lines long since known to exist in the enamel-rods, but shown by him to be far more delicate and numerous than ever described before. The square pieces of the enamel-rods are again subdivided into minute fields; they are separated from each other by delicate light interstices, and in all probability contain fibrillæ of living matter. Thus the enamel is raised to the dignity of a living tissue, in place of the former conception of its being a mere calcareous deposit. At the place of junction of the enamel with the dentine a direct connection is often seen between the enamel and dentine fibers. More commonly dentinal fibers run into the enamel varying distances, without a direct union between them and the enamel-fibers; as the latter do not generally reach the surface of the dentine, but terminate above its level, at different heights, while the zone close above their terminations is occupied by a delicate irregular net-work. In many places the dentinal canaliculi, upon entering the enamel, suddenly become enlarged and form spindle or pear-shaped cavities of varying diameters. They invariably contain

protoplasm which is in direct connection with the terminations of the dentinal fibers, and on their periphery with the fibers of living matter of the enamel. In the teeth of young persons the spindle-shaped enlargements are comparatively larger and more regular than in the teeth of old people. The boundary line between the dentine and enamel is usually slightly wavy and with more or less deep, bay-like excavations, the concavities of which are directed toward the dentine.

I.—Anomalous Relation between Dentine and Enamel.

Fig. I



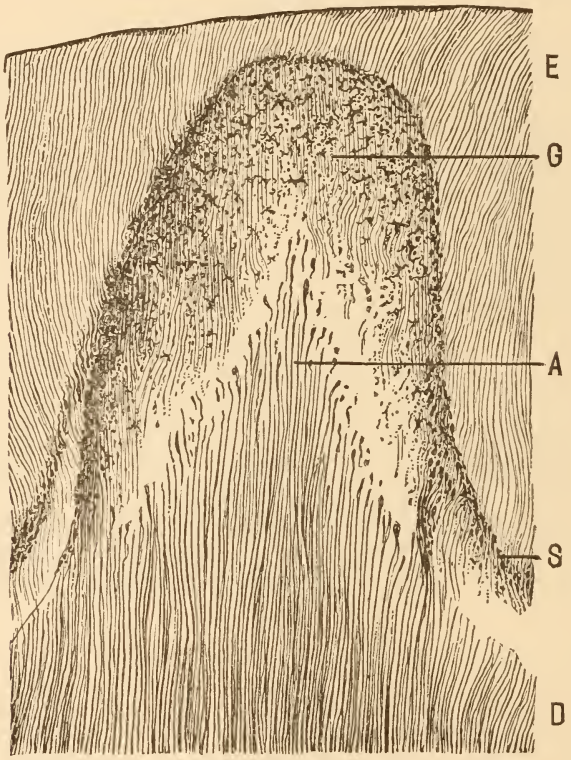
PROTRUSION OF DENTINE INTO ENAMEL.

E, enamel; D, dentine; H, hill of dentine with fluted summit; P, protoplasmic bodies in the dentine. X 400.

In examining a large number of specimens of ground teeth, I met with formations in two instances which are to be considered as rather anomalous, though not strictly pathological. In one instance, that of a temporary molar, there was on the buccal surface a protrusion of dentine into the enamel with a fluted surface, which was produced by a series of bay-like excavations, present also at the junction of the dentine with the enamel in this tooth in general, but not so marked as in this protruding spot. The center of this pro-

trusion was occupied by an eccentric protoplasmic formation, differing in shape from the ordinary interglobular spaces. The dentinal fibers at the periphery were bifurcated in the usual manner, but very few of them penetrated the enamel. The portion of the enamel nearest to the protrusion was destitute of prisms, while in the immediate vicinity such prisms were traceable almost in contact with the dentine. The zone immediately above the protrusion was but slightly brownish, whereas the prisms of the enamel exhibited a very distinct brown pigmentation.

Fig. 2



PROTRUSION OF DENTINE INTO PATHOLOGICAL ENAMEL.

E, enamel; D, dentine; G, granular enamel; A, summit of the dentine; S, sloping borders of the granular enamel. X 200.

In a second case, that of a permanent cuspid, also on the buccal surface near the edge, a protrusion of dentine was observed, occupying nearly one-half of the breadth of the enamel. This protrusion was of a conical shape, and without a distinct boundary, but

blended with an oblong field of enamel of quite remarkable structure. The dentinal canaliculi exhibited at their peripheral portions numerous bifurcations, and terminated in small pear-shaped enlargements, many of which could be traced in connection with dentinal fibers, whereas the most peripheral ones, owing to their devious course, looked isolated. The adjacent enamel showed but very indistinct rods, the main mass of the enamel being occupied by brownish globular fields, separated from each other by irregular interstices closely resembling the interglobular spaces of dentine, though of considerably smaller size. The deepest pigmentation and the largest number of such *interprismatic* spaces occurred along the periphery of this anomalous formation, especially toward the outer surface of the enamel. The vicinity of the enamel proper was marked by the presence of slightly pigmented rods, more wavy in their course than normal. Toward the dentine the anomalous formation was sloping, and the line of demarkation between the normal and anomalous enamel exhibited either brown and very wavy prisms or small *interprismatic* spaces, decreasing in diameter the nearer they approached to the dentine. I wish to emphasize and call particular attention to the fact that the dentine of this tooth was nowhere traversed by interglobular spaces; the anomalous construction being confined to the enamel.

II.—Stratification of Enamel.

It is known that dentine, without exhibiting pathological features, is sometimes composed of strata, more or less distinctly marked, slightly deviating from its normal structure, and altogether independent of the formations known as secondary dentine. We often meet with similar formations in the enamel. We observe layers varying in width and more or less sharply marked by a straight line, which in longitudinal sections of teeth exhibit concentric layers, the broadest portion always corresponding to the cusps, the narrowest always to the neck, of the tooth.

At the outer periphery of the enamel there may occur strata, which, contrary to the general construction as above described, are broadest toward the neck and narrowest toward the cusp, though never reaching its summit. In transverse sections the enamel shows simply concentric lines, separating from one another layers of greatly varying diameters. With higher powers of the microscope we ascertain the fact that the lines of stratification, as a rule, do not alter the general course of the enamel-prisms,—in other words, a single

Fig. 3

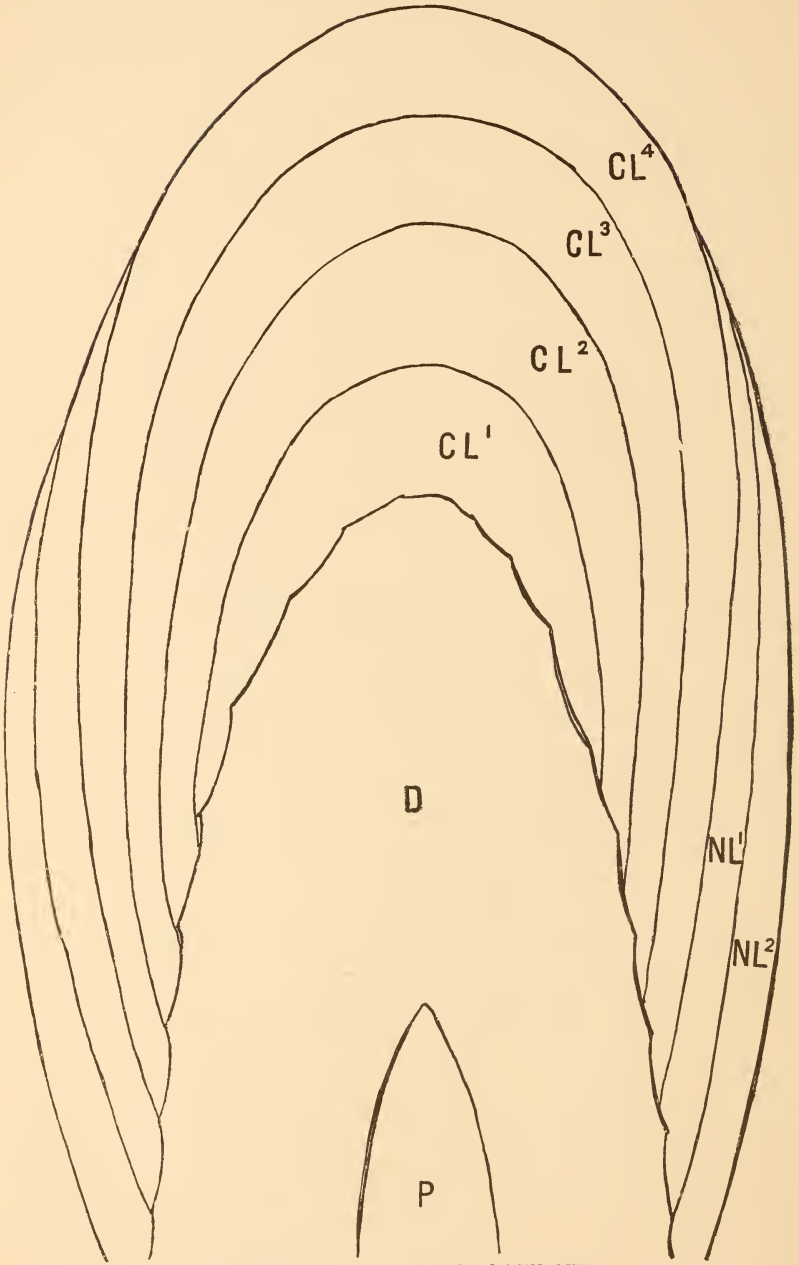


DIAGRAM OF STRATIFICATION OF ENAMEL.

P, pulp-chamber; D, dentine; CL1, CL2, CL3, CL4, cusp-layers of enamel; NL1, NL2, neck-layers of enamel.

enamel-prism will show an oblique line of demarkation, corresponding to the general line of stratification, without being altered in its construction or its course. An exception to this rule will occur only at the peripheral portions of enamel, occupied by the tapering ends of the above-described secondary strata, which I would like to term *neck-layers*, in contradistinction to the central *cusp-layers*. The tapering ends of the neck-layers may exhibit enamel-rods, almost parallel with the surface of the enamel, a feature which is never seen at the outer periphery of the cusp-layers, where the enamel-rods are invariably directed more or less vertically to the surface.

The stratification of the enamel is of the utmost importance for the understanding of its pigmentation and granulation. As I will show later on, both the pigmentation and granulation correspond to the general strata of the enamel, thus showing in longitudinal section of teeth a fan-like appearance.

It can scarcely be doubted that the stratification of this tissue is in close relation to the history of its development. We know that the first appearing enamel-cap of temporary teeth, in the seventh month of intra-uterine life, has the configuration of the innermost cusp-layer,—i. e., it is broadest in the direction of the future cusp, and tapers toward the future neck of the tooth. It seems reasonable to assume that the subsequent layers of enamel form on the plan of the first, but there may be a temporary stoppage of its construction, due perhaps to slight ailments of the mother before delivery of the child, or slight ailments of the infant after delivery, which causes interruptions in its organization. Slight ailments of a general nature will not interfere with the final result of an otherwise sound enamel; whereas severe ailments, particularly local, may lead not only to stratification, but to a decidedly pathological condition, which I have before called pigmentation and granulation. These conditions invariably involve a deficient deposition of lime-salts.

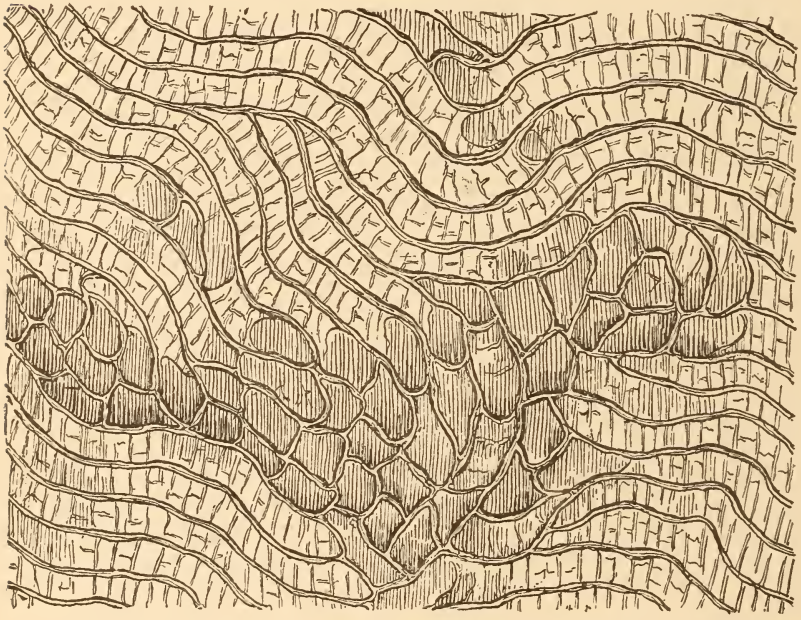
III.—Anomalous Arrangements of the Enamel-Rods.

In normal enamel longitudinal sections will, in the majority of cases, exhibit slightly wavy rods, interlaced by comparatively small bundles, cut in a transverse direction. Toward the periphery the curvatures of the rods gradually become less, until when close to the surface they present a nearly straight course. I have never seen transverse sections of enamel-rods directly in contact with the interzonal layer.

Deviations from this rule seem to be rare, and then the enamel-

rods seem to lack all regularity in their arrangement. It may occur that close to the interzonal layer the enamel-rods show extensive fields occupied by these transverse sections, which gradually blend with oblique and longitudinal, producing a wavy appearance, to such an extent that beautiful figures arise, reminding one of the grain of *lignum-vitæ*. Still more complicated figures arise if the transverse bars of the longitudinal rods are unusually conspicuous. In such enamel it may occur that the curvatures of the rods remain very marked up to the surface; and consequently groups of transverse sections may be seen directly at the outer surface.

Fig. 4



Extremely irregular course of rods in slightly pigmented enamel. The longitudinal rods deviating to a great extent from the field of the specimen, show oblique and transverse sections. The interstices are widened and contain very conspicuous enamel-fibers. × 800.

Enamel of this description may be seen only on one portion of the tooth, while the rest is normal. With this curly appearance of the enamel-rods, in all my specimens, pigmentation is combined as a marked feature, and the interstices between the rods are a trifle wider than normal. Both of the latter features must involve a deficient calcification, and consequently extreme brittleness. It is very

difficult to obtain perfect specimens of such enamel. The dentine subjacent to such anomalous formations is freely supplied with interglobular spaces (which is likewise a sign of deficient calcification).

IV.—Deficient Calcification of the Enamel without Pigmentation.

The friability alluded to under the previous heading is in some instances very marked,—so much so, in fact, that it is impossible to obtain an unbroken slab of a tooth even with the finest grinding-stones. With low powers of the microscope we observe that the broken ends of the enamel-rods look as if corroded, or as if some of them had been displaced or torn off by the process of grinding. Neither pigmentation nor an anomalous course of the enamel-rods is necessarily connected with such a condition of the tooth. The most striking feature, however, visible even with low powers, is that the enamel-rods are unusually narrow, the interstices between them unusually wide, and their tenants, the enamel-fibers, very prominent. The cross-lines of the enamel-rods are likewise considerably widened and irregular, so that the fields of basis-substance look unusually small and irregular. The reticulum in the immediate vicinity of the interzonal layer is also unusually prominent.

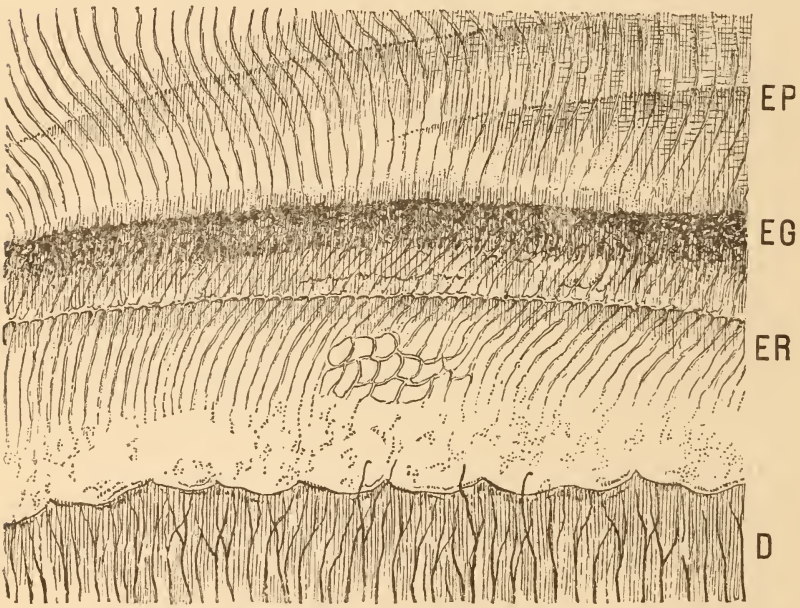
Such a condition of the enamel may occur both in temporary and permanent teeth, and may be combined with pigmentation. It is a feature of such deficient enamel that it readily stains with an ammoniacal solution of carmine, something that normal enamel will never do. The subjacent dentine, under such conditions, may either be perfectly developed, as before stated, or be deficient in its formation, as shown by the presence of more or less numerous interglobular spaces.

All clinicians have observed congenital white or yellow spots in the enamel of teeth, which if broken into are found to be of the consistence of chalk. Such spots have been termed "white decay," although they do not correspond to the process of caries as we usually understand it. They mean nothing but deficient calcification. Again, all clinicians have seen teeth across which a row of pit-holes exists, where in many instances in the bottom of the depressions no enamel is to be found. This condition is also always congenital, and closely related in its origin to pigmentation and the white or yellow spots. In other instances an originally smooth enamel is mutilated mechanically by the process of mastication, with the result of loss of substance, with abruptly broken, jagged edges. Again, we see

teeth with a great portion of their crowns covered by a brownish-yellow substance in place of enamel, which is so soft as to be easily removed, leaving the dentine bare of its covering and extremely sensitive to the touch of an instrument, the pressure of food in mastication, etc. These conditions, again, are, in most instances at least, connected with pigmentation and the white or yellow spots. We might call them exaggerated cases of the same condition. Obviously these congenital defects are dependent upon deficient deposition of lime-salts in the basis-substance, rendering the enamel less resistant and more friable.

V.—Pigmentation of Enamel.

Fig. 5



PIGMENTED AND GRANULAR ENAMEL.

D, dentine; ER, layer of slightly pigmented rods broken off; EG, layer of highly pigmented and granular enamel; EP, stratified pigmented enamel. X 400.

One of the most common pathological conditions of the enamel is its pigmentation. Sometimes it is so slightly marked that the naked eye discovers only a slight yellow-brown discoloration; in other instances it is quite prominent and readily discernible. Specimens of such teeth under the microscope will correspondingly exhibit

either a dim yellow tint in the enamel or a very marked brown discoloration. The pigmentation may occur either in non-stratified or in stratified enamel. In the first instance there is no demarkation of the brown spot toward the colorless enamel; only faintly-marked offshoots of the main spot, tapering toward the dentine, and running in an oblique direction, will indicate the fact that pigmentation has occurred during its formation. In the second instance, on the contrary, if pigmentation invades stratified enamel, there is a close relationship between the two, inasmuch as the deepest stain invariably corresponds to the boundary line of the strata, tapering toward the neck, and gradually fading toward the proximal end of each stratum. Thus, in longitudinal sections, a beautiful fan-like configuration is produced.

The pigmentation may invade all layers of the enamel, often being more marked in the deeper than in the superficial portions. Higher powers of the microscope reveal the following facts: First, that the brown discoloration concerns the basis-substance of the enamel-rods only. Secondly, that the interstices between the pigmented enamel-rods are widened,—not due to the contrast in color, but to a deficiency in the formation of the basis-substance. Thirdly, that the transverse lines of the enamel-prisms are likewise (at least in many instances) enlarged. Fourthly, that the enamel-fibers and their lateral offshoots are more conspicuous than in normal enamel, and more so even than in the enamel of temporary teeth, and in many places distinctly beaded. Pigmented portions of the enamel are very prone to take up a red stain on being treated with an ammoniacal carmine solution

As to the origin of the brown discoloration, I have to say, as a suggestion simply, that at the time of the formation of this tissue there must have been a disturbance in the enamel organ which interfered with the proper construction of the basis-substance and the deposition of lime-salts. What this disturbance really was, I am unable to say. All pigments of the body depend upon and are closely related to the coloring-matter of the blood. I am loath, however, at this time, to attribute pigmentation of enamel to the extravasation of blood-corpuscles or diffusion of the coloring-matter of the blood. Careful studies in the history of the development of this tissue must be made before an attempt at a solution of this question will be admissible. One point I am positive about, however, is that this pigmentation is congenital, invading temporary as well as permanent teeth. Acquired pigmentation of enamel seems to be of comparatively rare occurrence, except as a result of caries.

I have seen pigmentations of its surface, of a deep orange color, not penetrating the enamel-tissue in the least. Caries on the surface often causes an orange discoloration, diffused and fading toward the normal portions. Several of my specimens plainly show an invasion of the enamel by caries, on spots pigmented congenitally; secondarily, an orange diffused discoloration has taken place, which is likewise prone to take up the carmine stain; thus beautiful shadings of brown, orange, and red are to be seen, the brown being congenital, the orange acquired, and the red artificial. What chemical may lead to an acquired pigmentation or discoloration of the enamel I cannot say.

VI.—Granulation of Enamel.

Under this heading I propose to describe a very peculiar pathological condition of this tissue, which, so far as my specimens indicate, is by no means rare. It consists of pear, spindle, and club-shaped spaces in the middle of the substance of the enamel. Such spaces were known to exist heretofore at the junction of the dentine and enamel only. They may appear in pigmented and invariably do in stratified enamel; the stratification in the latter instances being due to their presence. Club-shaped spaces may appear at the distal boundary of one of the cusp-layers, or there may be several rows of such spaces, varying in extent and degree, but it sometimes occurs that only the outermost cusp or neck layers are freely supplied with them, whereas the rest of the enamel is normal or more or less pigmented.

Higher powers of the microscope demonstrate that the spaces are enlargements of the interstices between the prisms and the tenants of the interstices. The enamel-fibers are in direct connection with the contents of the spaces,—i. e., with living matter. The spaces, at their stem-like beginnings, run accordingly parallel with the interstices; but in their broader portions may cross the enamel-prisms in different directions. If they are few in number they may protrude from the boundary line of a cusp-layer, and penetrate the adjacent cusp-layer obliquely to the main direction of the enamel-rods. In this instance I could trace the connections of the enamel-fibers even with the club-shaped ends projecting into the neighboring cusp-layer. If these spaces are present in large numbers, the enamel, with lower powers of the microscope, will look dark and granular; hence the name "granulation of enamel" which I have given it.

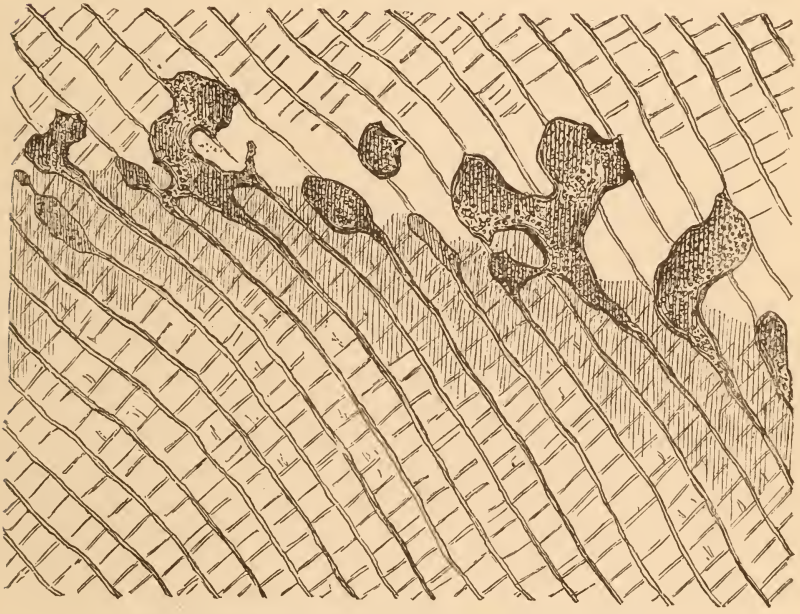
Fig. 2 represents this condition of granulated enamel with a low power.

Fig. 6 shows the condition under a high power.

In stratified and granular enamel, single strata may be produced by an interruption of the pigmented enamel-rods, by convex ends directed toward the adjacent peripheral cusp-layer. (See Fig. 5.)

The *interprismatic* spaces of the enamel bear some resemblance to the interglobular spaces of the dentine. I have seen both conditions in a highly-marked degree present in one of my specimens

Fig. 6



INTER-GRANULAR AND SLIGHTLY PIGMENTED ENAMEL.

Club, spindle, pear-shaped, and irregular spaces at the boundary of a cusp-layer in the middle of enamel. X 800.

Whenever these *interprismatic* spaces are present along the border of a cusp-layer they considerably lessen the degree of consistence of the enamel, which upon being ground easily breaks off along the dark granular line.

The nature of the *interprismatic* spaces is plain enough. They mean an incomplete formation of the enamel, owing to some deficiency of function in the enamel-organ during its formation. Ob-

viously not only the basis-substance is deficient, but also the amount of lime-salts is considerably less than normal; hence its brittleness and proneness to decay.

Under the foregoing headings I have described a number of pathological conditions of the enamel, which, at least so far as stratification, pigmentation, and granulation are concerned, mean a deficient formation of the basis-substance, together with decreased deposition of lime-salts. These conditions are, in my judgment, of the utmost importance in the etiology of caries. Ailments either of the mother during gestation or of the infant in the earliest periods of life obviously cause such anomalies in this tissue. These ailments are known to occur far more frequently in refined people, debilitated, as it were, by civilization, than in strong, hard-working, plain-living people, continually engaged in a struggle for life. Thus, I have directly demonstrated and anatomically shown, in a measure, at least, the reasons why refined people are far more subject to caries of the teeth than people lacking such refinement.

As to the literature upon the subject of pathology of the enamel, I have nothing to say, since, to my knowledge at least, none exists.

DISCUSSION.

Dr. Peirce: I want to congratulate the members of this Association upon the opportunity that they have enjoyed of listening to the joint investigations of Prof. Heitzmann and Prof. Abbott. I feel that these diagrams illustrate vital conditions of the hard structures of the tooth which are not readily brought before any society. The first diagram we have seen illustrates a condition that must have been confirmed in embryo. We have the projection of the dentine up into the enamel structure, along this border-line between the dentine and enamel, which is the line where calcification first takes place, and that must be as early as the fifteenth or sixteenth week of embryonic life; the soft tissue before hardening must have assumed this shape at that early period. The peculiar convoluted forms that the dentine presents of course assumed that appearance before they were made permanent by the deposition of the salts of lime. We get a lesson here in reference to the vitality of these structures, and how readily they are modified by abnormal nutrition or by delegation of nutrition to some other locality. The normal conformation of the dentine cap previous to calcification is hexagonal depressions, and in these hexagonal depressions are the feedings of the enamel fibers.

Here we have an irregular fluted condition greatly exaggerating that peculiar hexagonal depression which is given to the normal tissue. So, I should state that this peculiar condition, which evidences the projection of the dentine above the normal line into the enamel structure, was due probably to some peculiarity of the nutritive currents, as my friend Dr. Atkinson would call them, at that early period of embryonic life; that is, that there had been some modification in nutrition which induced this condition, both so far as the abnormal production of the dentine structure is concerned and the peculiar fluted appearance that this structure presents. We want to bear in mind the readiness with which these hard structures are modified by any systemic condition which occurs so early in life as it must have occurred to produce this peculiarity of structure.

We all readily recognize, as we look at a transverse section of a tree, the concentric lines which are said to represent its age, though in reality they do not. They represent periods of growth and rest, two or three of which may have occurred in one year, though as a rule they do not occur more than one in a year; but they may have occurred more frequently, owing to the peculiar condition of the nutrition, or the condition of the atmosphere or rain-fall, which may have induced or retarded the growth. So frequently do these concentric layers represent the age of the tree that it is very common when a tree is cut down to state that those layers show its age. So, from my own investigations, I am satisfied that these lines do represent a peculiar condition which the enamel presents, as if it had grown like the tree in concentric layers,—periods of growth and rest. So we oftentimes find in the section of a tooth these concentric layers, not so decided as these lines in the diagram represent, but sufficiently so to indicate that there has been nutrition and then cessation of nutrition, showing how liable that structure is to be influenced by systemic conditions during its period of calcification. Remember that the soft tissue does not much precede in growth the hard tissue; it is not all developed before calcification takes place. We have the border-line of the dentine and enamel developed in soft structure, and then the deposition of the salts of lime which make them permanent, unless afterwards disturbed by the organic portion losing its continuity with the inorganic. Some systemic condition may afterwards interfere with the continuity existing between the tissues,—the lime-salts and the organic parts,—and by losing continuity the structures may be somewhat disturbed.

My object was first to call attention to the interesting specimens,

and to the fact that those structures at that early period are so liable to be left undeveloped by abnormal systemic conditions.

Dr. Atkinson: I am very much delighted with these specimens as proofs of the idealism of the various observations in the histology of tooth-substance, and our familiarity with the processes will give us the measure of the value of our deductions. We may make a very good case out of an anomalous one if we take the anomalous case to be the regular order; but if we understand the functions of the enamel-pulp, we will find that it is not always its purpose to be finally elaborated into enamel-rods or prisms and interspaces that occupy the divisions between the prisms. So the mere fact of our being acquainted with the structure of this embryonal mass, which has been called a congeries of stellate cells, out of which the ameloblasts arise from which the enamel-rods are produced where the type demands enamel as a protection to the dentine, leads us to inquire the significance of all teeth having an enamel-cap, whether they are to be examples of enamel, dentine, and vaso-dentine or not. It is well known that many teeth of the lower orders of animals are made up of the lowest form in which dentine plays a part at all,—vaso-dentine, —the pulp sending off-shoots into the dentinal structure in the interior of the tooth, having a more solid form or hardened condensed structure on the outside that is ultimately to be used in the grasping of food. These are in most instances laniary teeth, and belong to the carnivorous inhabitants of the waters. What becomes of the enamel-cap that in the embryonal condition presided over this is not settled. Sometimes it is worn off. It is always inside of Nasmyth's membrane, and where enamel and dentine obtain, as in the mammalian teeth, they are always built inside of Nasmyth's membrane when there is no interference with the currents of growth. The very fact of the statement that there is nutrition belonging to the enamel settles the question of whether it is a mineral, animal, or vegetable substance.

How does this specimen No. 1 come about? Simply by a fold in the enamel-cap on its lower border allowing the ameloblasts to persist beyond their normal life; so that this is a kind of abnormality that can hardly be said to be pathological. I think it was not directly asserted by Dr. Abbott that that was the precedent state of the unbuilding of the tooth; decay being the taking down of the structure that was built by the stored radiancy or the impact of light that is the immediate precedent step in the formation of all organs.

I do not care to go through all these specimens, because there was

so much of what I deem unwarranted deduction from these nominations for graduated conditions,—simple stoppages as it were, arrests of the normal processes of growth,—that I wish merely to make a few statements as to what I regard the misuse of terms. Invariably it is attributed to want of lime, and that was distinctly stated by Prof. Abbott's paper, which I deny. It is not a want of lime. There is as much lime in these territories, *pro rata*, as there is in any other like territory of what are called well-formed teeth. What is the difference? It is the difference in the togetherness, the consolidation of the lime-granules that constitute the basal substance of the enamel or dentine. What that is is too fine to be presented until after we have made many more observations; and let me here say that I hail with great pleasure the ambition of any one to work at this subject. I feel a little as Paul did: I don't care whether Christ be preached of envy or of good-will, so that Christ be preached. We do owe, as the paper states, a great debt of gratitude to Dr. Bödecker for his unwearied exertions in this direction, and his successful demonstration of the living matter in dentine and enamel. But how they come to be and how they shall be precedent steps to the unbuilding that we call decay, does not appear until we shall have penetrated a deeper field than any of the microscopists have entered upon and recorded. I mean to say that every microscopist does enter upon this field, but as soon as he sees the key-hole he smells at it and turns around and swears there is no door, lock, or key-hole there, and then he goes back to the old method of mass presentation. It is vain to have a microscope and not have a trained mind behind it, a trained eye to interpret what the image means that impinges upon the visual apparatus; and that is where I always want to bear testimony and offer my thanks to Carl Heitzmann for the grand work that he has done to make it appear that a man must devote his life to these examinations to enable him to arrive at anything like just conclusions.

Dr. Thompson: I want to ask Dr. Abbott a little more about the structure of the chalky spots in the enamel; if he considers them to indicate a deficiency in lime-salts, or a deficiency of organic animal elements?

Dr. Abbott: The only evidence that we have that there is a diminution in the amount of lime-salts is that there is a greater amount of organic material to be seen in the specimen under the microscope. It shows two or three times the amount of organic material that normal enamel does, and the tooth must of necessity

be so much short of inorganic material. The lime-salts are, comparatively speaking, loose, and readily removed with the finger-nail. Crowns of such teeth are often broken in masticating, leaving the broken surface *excessively* sensitive,—much more so than is experienced when a healthy tooth is broken in the mouth; thus showing that a greater amount of organic matter is exposed, and that it is abnormally irritated.

Dr. Brophy: I believe that Dr. Abbott stated that the defects appearing in the enamel when the teeth were erupted were always congenital.

Dr. Abbott: I do not see how they could very well be otherwise.

Dr. Brophy: According to some observations of Prof. Eames, of St. Louis, indorsed by Prof. Black, of Jacksonville, it has been shown, and I think quite conclusively, that defects may appear in the enamel of the tooth as a result of absorption similar to that which occurs when the roots of deciduous teeth are absorbed, and, as they claim, by the same agent that produces absorption of deciduous teeth roots. Since Dr. Abbott spoke of that I would like very much to know what his observations have been upon that particular point. It seems to me that such an absorption may take place. I have in mind a few cases in which I am quite satisfied that there has been a destruction to a considerable extent of the enamel of the permanent incisors, due to retaining the temporary teeth too long.

Dr. Abbott: I would state in answer to Dr. Brophy that in my judgment it would be almost impossible for the conditions he refers to to occur after the teeth had erupted. I should think it was stretching a point a good deal to say that the same changes could possibly occur in the enamel of a tooth, by way of absorption, as occur on the roots of the temporay teeth. I cannot see what would or could bring it about, or how it could occur? I have never seen nor heard of such a case.

Dr. Atkinson: I gave Dr. Abbott some years since a specimen, a section made twenty-seven years ago, that showed the enamel was invaded by the same retrogressive process that the dentine is. And Dr. Abbott gave me a specimen, long ago, that had lost two-thirds if not four-fifths of its root. It was a superior cuspid, and it was perforated to all appearance by beautifully drilled holes. That has not yet been cut; but I deduce that it is nothing but a retrogressive metamorphosis; but why the holes should take a cross-line I do not pretend to understand. The fact is as stated. I no not understand either how the denuding process should take a serpentine course

across certain teeth, and out of the line of mechanical action. We have much to learn, but I wish to state what I discovered over twenty-seven years ago. I have some specimens that will demonstrate the same thing. We are getting hungry for the truth, and that is what we want to search for.

Dr. Abbott: The specimen that Dr. Atkinson was so kind as to loan me, which was cut twenty-seven years ago, was not one of this character at all. It had no more resemblance to it than chalk has to cheese. It was a case of absorption; these show imperfect development of enamel. I feel quite indignant that the doctor should not have ground that beautiful specimen of a tooth that I gave him some twenty years ago, which he promised at the time to do.

SECTION V.—Continued.

The Alveolo-Dental Membrane: Unity or Duality—Which?

Voluntary Paper by L. C. INGERSOLL.

THE tissue named as the subject of this paper commends itself to the thoughtful consideration of the dental profession by higher claims than any other tissue of the formed tooth. There is no health, comfort, usefulness, or safety to the dental organism except this membrane be preserved in health, vigor, and entirety. For the last quarter of a century the attention of the profession has been almost wholly absorbed in the preservation of the enamel and dentine by various methods of filling, and of the pulp by various methods of therapeutical treatment and capping.

Let the entire tooth-crown be wasted by the ravages of decay, and let the pulp die, if but a vigorous root-membrane remains, on the root may be built up a crown the most complete of anything artificially supplied in the human mouth. On the other hand, though the natural crown be perfect, and the pulp still performing its functions, if the alveolo-dental membrane fails the whole structure is gone.

Recently more attention has been given to the diseases of this membrane as manifest in alveolar abscess, superficial and deep-seated ulceration, and in *peripyema*, or, as in modern days it has been called, pyorrhea alveolaris. While close and careful study has been given to and much has been written upon these diseases, the histology of the tissue involved has scarcely been named or thought of.

In looking over the pages of the *Dental Cosmos* for the whole period of its publication, I do not find a single article referring to the peculiar structure of the peridental membrane except one penned by myself, eleven years ago, entitled "A Plea for the Peridental Membrane." It was written with the hope that some one, more competent with the microscope than I, would enter this field of in-

vestigation and give to the profession the results. But no one has seemed to take the bait held out, or to have any relish for the digestion of the very limited number of facts now revealed as a basis for more extended research. The subject is surrounded with difficulties. Authors of dental works have universally ignored it as belonging to the dental tissues. Not one of our standard authors has ever named more than four as constituting the group of the dental tissues,—viz., enamel, dentine, cementum, and pulp,—three hard and one soft tissue. In studying the anatomy and physiology of these four tissues, years of time have been spent and hundreds of pages have been written. This work has been deemed essential to the right understanding of their diseases. But as no author has ever seen fit to even name the alveolo-dental membrane as belonging to the family of the dental tissues, it has been given but a passing notice, and its diseases have been treated of without special reference to its structure or peculiar relations to the contiguous tissues.

It is not my purpose in this paper to enter into any extended discussion of its peculiar structure, but rather to pick up the fragments of our literature on the subject; then to draw some conclusions as a starting-point for future investigations.

The first question to be decided is, Does it belong to the dental tissues?

To understand its nature and relations, reference must be made to the *dental follicle*, in which all tooth-tissues have their origin and begin to assume their appropriate functions and relations to each other and to surrounding tissues.

Let us call to mind the mucous membrane with its two distinguishing layers, the *epidermis* and the *dermis*, with the membranous line of division between the two known as the *basement membrane*. In the outer layer—the epidermis—the enamel has its origin. In the inner layer—the dermis—the dentine and all the remaining tooth-tissues have their origin.

We are accustomed to divide the fully-formed tooth, for anatomical purposes, into three distinct parts,—the *crown*, exposed to view in the mouth; the *root*, concealed from view by being covered with the gum and the alveolar processes; while that portion covered neither by the enamel nor the alveolar bone, but serving for the attachment of soft tissues to the root, we distinguish as the *neck*, the same corresponding also to the neck of the follicle. It is this *neck*, common both to the follicle and the tooth, to which I wish to call special attention. This will be our starting-point in the investiga-

tion as to the proper classification of the tissue lying between the root of the tooth and the alveolar wall.

The early anatomists, regarding the teeth simply as bones, classed the membrane covering the *roots* of the teeth with that investing the contiguous bone as belonging to the osseous system; hence they called it the *alveolar periosteum*. Not willing to ignore the teeth entirely as a part of the skeleton, when speaking of the teeth and their surroundings they called the same membrane the *dental* periosteum. In either case the use of the word *periosteum* indicated that they understood that it held its chief relationship to the bone structure, like all periosteal tissue, and they had no distinctions to make between the periosteum of different bones. If it belongs to the osseous system, it should be born with that system. If it belongs to the dental structure, it should be born in the dental follicle, and connate with the other dental tissues.

Of the three parts of the tooth named, the crown is the first in the order of development. The next development is the neck, which is now at the base of the dental follicle, where the follicle itself has its vital connection with the sub-dermal tissue, whence it derives its nerve and vascular supplies. This follicular neck, which is the constricted portion of the follicular wall, and marks the base of the dentine germ or papilla, which becomes the pulp of the future tooth, is a point of peculiar interest. Legros and Magitot say—and it was noticed by Robin and Magitot (1861)—that "for a long time before the formation of the first dentine cap there appears between the follicular wall and the organs within it a new tissue, very distinct from the neighboring parts in color, consistence, and composition. This is the organ upon which will subsequently depend the formation of the cement." In harmony with this account of the origin of the peridental membrane, we find in Tomes's "Dental Anatomy" (page 102) the following: "It should be borne in mind that the tooth-pulp and the tissue which becomes the root-membrane have sprung from the same source." This is all I have been able to find in our dental literature, or elsewhere, concerning the origin of the peridental membrane. As there are no conflicting opinions on the subject, and if the fact stated above shall be demonstrated (as Magitot thinks he will be able to do), we must for the present take it for granted that it originates in the dental follicle, and has an equal claim with other tissues originating there. No one has any doubt that the pulp is one of the dental tissues, it being the formative organ of the dentine. By parity of reasoning, we

should have no doubt of the peridental membrane belonging to the group of the dental tissues, it being the formative organ of the cementum.

We find now at the neck, common both to the follicle and the forming tooth, a cluster of encircling tissues,—the follicular wall proceeding upward and covering the crown of the forming tooth, the germinating cells of the root-membrane developing downward with the progress of the developing root, and outside of these a layer of osteoblast cells for the construction of bone to support the growing tooth. In other words, the alveolar walls develop simultaneously with the root of the tooth, though alternating as to the exact periods of time when the increment of lime-salts in each may be observed. Every illustration in our books showing this developmental stage of the tooth-formation shows also the development of the contiguous bone,—especially seen in the excellent illustrations furnished by Dr. G. V. Black for Dean's translation of Legros and Magitot's "Dental Follicle."

Just here let it be particularly observed that proceeding out from the base of the dental follicle is a line of cells encircling the neck of the tooth destined to become the formative organ of the cementum, and immediately contiguous there is another encircling line of cells, originating in the surrounding embryonic bone, and destined to become the formative organ of the alveolar walls and the whole ridge of bone known as the alveolar ridge. For this purpose the osteoblast layer of cells develops downward to form the socket, while the cementoblast is also developing downward to form the cementum; and these two developments are contiguous to each other.

Having thus brought to your notice the different parts of the forming tooth at its neck development, their relations to each other and to contiguous tissue-formations, we come to the main question at issue in this discussion, namely, Is the tissue now forming at the neck of the tooth, and destined to occupy the space between the cementum of the root on the one hand and the alveolar wall on the other, *one membrane?* Is the tissue now known as the dental periosteum, and also as the alveolar periosteum, a single or a double membrane? Has it unity, or duality, in its structure and relations?

It has been so generally conceded that the membrane lying between the root of a tooth and its alveolar walls is a single membrane, that the repetition of the statement of its oneness by a suc-

cession of authors for the last half century has called forth no dispute. Occasionally a writer has ventured an opinion that it existed as a double membrane; but the opinion expressed has elicited no discussion or systematic investigation. Less has been written concerning the peridental membrane than concerning any other of the dental tissues.

Fifty years ago the dental membrane, as it was called, was said to exist in three parts, or as three distinct membranes,—one forming a lining of the pulp-cavity and the root-canal, another covering the root externally, and still a third covering the walls of the alveolus. When the mistake was discovered as to the lining of the pulp-chamber, there being no membrane found there other than the odontoblast layer of pulp-cells, the conclusion was hasty and definite that the portion external to the root lying between the cementum and the parietes of the alveolus was but a single membrane. The early anatomists are wholly silent concerning its structure. Later writers have voiced the general sentiment in few words, that it is a connective-tissue membrane, of fibrous structure, intermingled with cells, the bundles of fibers passing in an oblique direction *entirely across* from the cementum on the one side to the bone on the other, and well supplied with blood-vessels and nerves. The common sentiment on this subject has been given the greatest prominence and boldness of statement by Charles S. Tomes, in his "Dental Anatomy" (page 101). He says: "A mere inspection of the connective-tissue bundles, as seen in a transverse section of a decalcified tooth in its socket, will suffice to demonstrate that there is but a single membrane, and that no such thing as a membrane proper to the root and another proper to the alveolus can be distinguished; and the study of its development alike proves that the soft tissue investing the root and that lining the socket are one and the same thing; that there is but one membrane, namely, the alveolo-dental periosteum." Although Mr. Tomes speaks with the greatest positiveness concerning its oneness and identity of parts, the varying terms by which it has been named show a great indefiniteness in the minds of writers as to its nature and relations; and the fewness of those who have expressed a definite opinion, and the little that has been written upon it, give evidence of the extreme difficulty of making sections which will give satisfactory opportunity for study. Kölliker, in his extensive work of eight hundred pages on "Histology," has thirty-three pages on the human teeth, with only *four lines* of the whole on the structure of the root-mem-

brane. When you attempt the study of it by reference to authors, you will find how shy all have been of discussing its origin and relations, though writing extensively concerning its diseases.

Yet, as we shall see, our literature, while teaching the oneness of this membrane, gives us such descriptions of its structure, its origin, and functions as to create in the mind a doubt of its oneness, and some writers venture an opinion favorable to its dual existence. The fact that it has so uniformly been called periosteum naturally leads us to inquire into the structure of periosteum. Kölliker says: "The periosteum is not everywhere constituted alike. Where mucous membrane rests upon bone the periosteum is, in most cases, very intimately united to it, so that the two cannot be separated, but constitute a single membrane, as in the alveolar processes. With respect to the intimate structure of the periosteum, it will be found to present almost universally *two layers*, which, although closely connected, differ more or less distinctly in their structure. The periosteum of the alveolus is very intimately connected with the fangs of the tooth, and has the same structure as any other periosteum." This much, then, Kölliker says,—that the alveolar processes at their margins are only covered with the mucous membrane without any underlying gum-tissue, and have a periosteum existing in a single layer; but that the periosteum dipping down from the margin into the alveolus exists in two layers like any other periosteum. We may with propriety ask, Where does it get its other layer? Gray makes the same statement concerning the periosteum in general, that it exists in two layers; then quotes approvingly the language of Kölliker concerning the structure of these two layers. So far as I can learn, anatomists agree as to the structure of periosteum in general, that it exists in two distinct layers. If, therefore, the alveolo-dental membrane is a true periosteum, as all the earlier writers regarded it, we shall expect to find it existing in two layers. While analogy leads us to expect it, demonstration proves it. When a tooth is extracted from its socket the root is found covered with a membrane of soft tissue; and when the alveolus is examined the walls are also found to be covered with a membrane, which not only proves the duality of the root-membrane, but that one may, by violence, be separated from the other. This can most distinctly be observed by the unaided eye in cases of chronic inflammation of this membrane.

The fact that after the extraction of a tooth a membrane is left lining the alveolar walls is plainly evident from the additional fact that

a case of necrosis arising from simple extraction without fracture of the bone is never known; whereas, if the periosteal covering of the bone was removed with the tooth, cases of necrosis and exfoliation of the socket would be common and almost inevitable.

If, now, the root-membrane exists in two distinct layers or parts, have the two parts the same origin? Kölliker says that the periosteum covering the alveolar processes has but a single layer,—that this is exceptional with regard to periosteum. It is favorable, however, to the idea of a double membrane between the root and the alveolar walls. For it is almost uniformly stated by writers that the lining of the socket of the tooth is but a continuation of the membrane covering the alveolar processes externally, and that the shell of bone forming the socket does not differ from the corticular portion of bone forming the processes. This being the case, the origin of the alveolar lining must be referred to the osseous system, and its function is to form the bony walls of the alveolus. On the other hand, Legros and Magitot speak of the origin of *another* membrane at the base of the dental follicle, between the follicular wall and the organs within it, and very distinct from the neighboring parts, which becomes the formative organ of the cementum. Will any one pretend that the authors intended to include the organ that forms the alveolar walls; that the membranous organ born within the dental follicle, and by its origin declaring itself to belong to the family of the dental tissues, becomes the organ that forms the alveolar processes, which belong distinctively to the osseous system? Is it not much more rational to suppose that the bony socket is built up by a periosteum of its own, like the other compact corticular bone of the alveolar processes?

We now find two membranes, arising from opposite directions yet lying in immediate contact with each other, which become intimately united. This intimate union of the two does not, however, constitute them one membrane in any such sense that they lose their duality. For the *more* intimate union of the membrane with the cementum does not constitute these two tissues one; nor does the like intimate union of the periosteal membrane with the bone constitute both one. They are still distinct and separable.

Having found two membranes or layers, of different origin, yet performing a similar work, in harmony with each other, let us next inquire as to the structure of these two layers. Kölliker's statement is that the dental periosteum does not differ from periosteum generally, and for this reason he writes but four lines concerning it;

considering that he has sufficiently treated of its structure in connection with the osseous system. Of the periosteum he says: "The outer layer is composed chiefly of connective-tissue, with occasional fat-cells, and is the principal seat of the true periosteal vessels and nerves; whilst in the inner layer elastic fibers, commonly of the finer sort, constitute continuous and often very thick net-works." Tomes, in writing of the alveolo-dental membrane (page 101), says: "At that part which is nearest to the bone the fibers are grouped together in conspicuous bundles; on its inner aspect, where it becomes continuous with the cementum, it consists of a fine net-work of interlacing bands, many of which lose themselves in the surface of the cementum." Again, he says: "Although there is a marked difference in histological character between the extreme parts of the membrane" (i.e., between the part next to the bone and the part next to the cementum), "yet the markedly fibrous elements of the outer blend and pass insensibly into the fine net-work of the inner part, and there is no break of continuity whatever." The chief difference, therefore, between Kölliker's description of the periosteum and Charles S. Tomes's description of the root-membrane is, that what the former calls "layers" the latter calls "parts." Wedl says but little concerning its structure, but intimates that he considers it a continuation of the periosteum of the alveolar processes. He says: "The root-membrane is a delicate connective-tissue membrane, containing an abundance of vessels and nerves; it is intimately connected with the submucous layer of the gums and with the periosteum of the alveolar processes, and covers the root of the corresponding tooth." He then quotes Magitot, in the following words, "The root-membrane consists of two portions: an inner, which does not admit of being teased into fibrils; and an outer, which has the appearance of a fibrous structure." Spence Bate, a distinguished physiologist of England, says that "two distinct structures may be traced in the tissue which connects the root of a tooth with the walls of the socket, viz., the peridentium of the tooth and the periosteum of the bone." The former he regards as a dermal tissue; the latter as belonging to the internal or osseous system. He then says further "However closely in juxtaposition the two may approximate, they still hold their relative connections widely apart. The cementum is the production of the inner surface of the peridentium, and is in no way connected with or dependent upon the periosteum of the socket." Concerning this view of Spence Bate, John Tomes, in his "Dental Surgery" (page 505), remarks: "Although the presence of

the two membranes may be assumed to exist, it would, I think, be extremely difficult to demonstrate them individually."

Now let us return for a moment to the statement of Mr. Charles S. Tomes, author of "Dental Anatomy," who gives such positive utterance to the statement of authors generally on this subject, that the fibers constituting in large degree the alveolo-dental membrane "run across from the alveolus to the cementum, without break of continuity." This is the chief fact, or *supposed* fact, on which the teachings of the oneness of the membrane depend. But mark Mr. Tomes's words. He says: "The fibrous elements of the outer part blend and pass insensibly into the bands and fine net-work of the inner part." He confesses that he has never been able to trace the fibers through from side to side; hence says that they pass "insensibly." *Insensibly* means in a manner that cannot be discerned by the senses. If he is not able by sight or touch, or any other bodily sense, to learn that the fibers do pass through from side to side of the membrane without break of continuity, how can he know that they do thus pass through? He says, as before quoted, that there is a marked histological difference between the tissue next to the bone and the tissue next to the cementum, and the most that he is able to say of the union of the fibers entering into the structure of each is that it is an "insensible" union, *i.e.*, that it is not knowable by the senses. It is, therefore, a mere inference.

I recently visited my friend, Dr. Black, and examined his large collection of microscopical sections to see if I could learn anything from that source of the peculiar structure of this membrane. He had found the same difficulty that others have in obtaining a clean-cut section of tooth-bone and membrane with the several parts *in situ*. After presenting some sections which were more or less stretched, marred, and mangled, he exhibited one prepared from a human tooth, with the alveolar wall attached, which seemed perfect in all its parts. I could discover no tearing or displacement of its parts. In this section, under the microscope, the cemental membrane and the osseous membrane appeared of entirely different structure. Beginning my observation on the cementum side, first was seen the fine net-work in the meshes of which were lodged the cementoblasts, forming a complete line along the surface of the cementum. Then the bundles of fibers composing this delicate reticulum were seen spread out into flattened bands, lying side by side and nearly parallel with each other; as if you should take several threads of dental floss-silk and tie a knot in the end of each

to represent the cementoblasts; then, placing the knots irregularly together, should spread out the delicate fibers of the free ends of the floss-silk into a continuous flat band. In the specimen these fibers pursued a very oblique and slightly curved course toward the bone. Tracing them to near the middle line of the whole tissue, the obliquity of the fibers was changed by a curvature into a line parallel with the line of the cementum, and on this line all trace of straight fibers was ended, and all beyond was reticulated, forming large, irregular meshes, bounded by conspicuous bundles of fibers, and appearing of a much coarser make than the very fine and delicate reticulum before mentioned as lying next to the cementum, and the osteoblasts much larger than cementoblasts. I called Dr. Black's special attention to the fact that we lost sight both of the obliquity and the straightness of the fibers on about the middle line between cementum and bone. When I alluded to the statement so commonly made that the alveolo-dental membrane is almost identical with periosteum, Dr. Black remarked, "Why, no; it is very different from periosteum, as I will show you." Then he brought out his slide of periosteum. In this I observed a perfect identity with that portion of the alveolar membrane lying next to the bone, but found in it none of the straight parallel fibers seen in the layer next to the cementum,—confirming what I have here said of one layer of this membrane being but a continuation of the periosteum of the alveolar processes.

C. Heitzmann, in his "Microscopical Morphology of the Animal Body," permits Bödecker to say for him, that "only in a few specimens have I seen close around the root a thin layer of very dense and fine fibers, the general direction of which was not fully identical with that of the connective-tissue composing the main mass of the pericementum. There are two varieties of pericementum,—one of a reticular structure, the other altogether fibrous." Mark, Bödecker has seen a few specimens in which the fibers of the part next to the cementum are not identical with the part next to the bone; then says that there are "two varieties of pericementum." So we have a new phraseology for distinguishing between the parts. What one calls *parts* and another *layers*, he calls two *varieties*, —fibrous, and reticular. Thus, his observations are in perfect harmony with the idea of two distinct membranes, though teaching (no doubt from habit) with others the oneness of that membrane.

My fifth inquiry regards their functions. Are the functions the same? The outermost membrane forms bone, while the innermost

membrane forms cementum. But bone and cementum are usually considered identical. Is it, however, safe, with all the differences of origin, structure, and relations of the organized tissues that form bone and cementum, to say that these two hard tissues are identical? Can we say more than that they are similar in their structure? John Tomes, who has made special observations on the structure and development of bone and of cementum, after describing the processes of bone-formation, says, "The foregoing description of the formation of primary bone developed in connection with fibrous tissue might, with but slight modifications, be applied to the development of the cementum." Thus, he makes out the cementum to be *not* identical with bone, but *modified* bone. The observations of Mr. Tomes are in harmony with Sharpey and Shelly, both of whom made like investigations concerning these tissues,—which show that bone and cementum are not *perfectly* identical; that the cell of the cementum, the cementoblast, is a modified form of the osteoblast; and the resultant hard tissue a *modified* form of bone. Pathology will no doubt reveal to us a corresponding difference between the hypertrophy of cementum and the hypertrophy of bone; in other words, that there is a difference between *exostosis* and *excementosis*. This difference of function will more plainly appear in a future point of inquiry.

The sixth point of inquiry is, Have the two membranes, so closely in contact and united, different sources of nerve and vascular supply? We should naturally infer this difference if the grounds already taken are found tenable. If, with Legros and Magitot and Spence Bate and Charles Tomes and others, we find the membrane depositing the cementum to be of dermal origin, and from the same source as the pulp, we should expect it to derive its nerve and vascular supply from the same source as the pulp. If, with John Tomes, Wedl, Gray, and others, we find the membrane forming the bone of the socket is derived from the osseous system in common with other periosteal tissue, we should naturally expect it to derive its nerve and vascular supply from the same source. Wedl says ("Pathology of the Teeth," page 59), "The blood-vessels of the root-membrane originate from three sources,—from the submucous connective-tissue of the gums; from the dental vessels that supply the pulp, and from the intra-alveolar vessels inclosed in a porous osseous canal." Of the nerve supplies he says, "They are branches of the dental and of the gingival nerves, and in part are composed of filaments which come through the foramina in the alveolar walls

and from the alveolar canals." Thus we see they—both blood-vessels and nerves—come into the sockets of the teeth from two opposite directions: from the end of the root of the tooth and from over the margin of alveolar border; from the pulp on the one hand, and from the submucous tissue of the alveolar processes on the other. Be it remembered, however, that the submucous tissue on the thin alveolar processes is only periosteum. Other than these, the intra-alveolar canals afford a measured supply. Charles Tomes, after stating that the root-membrane and the pulp have a common origin, says, "A recognition of this fact makes it easier to realize how it comes about that their vascular and nervous supplies are so nearly identical." It is not necessary for Mr. Tomes to go beyond the nerve and vascular supplies of the pulp to quicken and nourish the root-membrane, believing as he does that it is *one* membrane in all its relations and parts. For who can conceive of the necessity for any more extended sources of supply for a membrane so thin and delicate? Born of the same tissue as the pulp, it naturally takes with it its mother's blood and nerve. But if there be joined with it in close matrimonial alliance another membrane, born of other tissue, the osseous system, we should just as certainly expect that it, too, would take with it its mother's blood and nerve. Either supply would be ample for a single and inseparable-membrane. The supply from both sources seems superfluous, except on the admission of the fact of the dual existence of the root-membrane,—more properly called the *alveolo-dental membrane.*

I shall next, and lastly, inquire into the teachings of pathology on this subject. Irritations and inflammations follow the courses of the nerves and blood-vessels, both by contiguity of tissue and by their reflex and sympathetic relations. The nerves control functional action. The nerve supply to any organ is therefore the medium through which functional action in that organ is excited. Excitation too intense becomes irritation, and results in diseased functional action. This is as true of the alveolo-dental membrane as of any other organ. Under the influence of an irritant affecting the root-membrane through the medium of a diseased pulp, this membrane is liable to take on abnormal action, renew the formative processes, and deposit a superfluous amount of cementum on the root. The irritation and the inflammation are, in this case, communicated to the root-membrane through the nerves and blood-vessels supplying the root-membrane and the pulp in common. This diseased condition, in which a superabundance of cementum is deposited upon the

roots, is called in the books *exostosis*,—which should, with more propriety, be called *excementosis*,—thus recognizing the true location of the deposit on the previously formed cementum and not on the contiguous bone.

If, as is stated by Tomes and others, the nerves and blood-vessels follow the course of the fibers forming the membrane, and pass entirely through the membrane from one side to the other, thus supplying both parts or layers of the membrane with the same nerves and vessels, why are not both layers excited into the same renewal of functional action, and why do not both form a deposit of lime-salts upon the surfaces they respectively cover? Why do we not find both exostosis and excementosis?—the one process forming an enlargement of bone in the direction of the root, and the other an enlargement of the root in the direction of the bone? The two enlargements impinging, ultimately, upon each other, would be fused; and we should find frequent cases of dental anchylosis,—or, speaking after the manner of the laity, "teeth grown to the jaw-bone." But such a case has never been found. It is only possible on the theory of the unity and inseparable character of the membrane; but rendered impossible on the theory of its dual character and relations.

When excementosis is found on two roots of the same tooth, it is not uncommon to find that the deposit, increasing from opposite directions, finally forms a contact and a complete fusion of the roots together, because both are under the influence of the same set of nerves. On the other hand, we never find exostosis of the socket and excementosis of the corresponding root; hence no osseous union of the two. Instead of the membrane covering the walls of the socket taking on formative action like its fellow, it takes up the work of absorption, and portions of the socket are removed, and the capacity of the alveolus is enlarged to make room for the excementitious enlargement. This makes it evident that they are *not* under the excitation of the same nerves. The vascular system, too, would be found contributing to the same ends. Nerves and blood-vessels attend each other in their developmental work, whether normal or abnormal. The inflammatory action in the membrane would induce a hyperemic condition to supply the material for the abnormal growth of cementum. If the same blood-vessels passed through to the other side of the membrane, and the superfluous amount of material was not utilized in new growth, as on the side toward the root, we should find extravasation of blood, breaking down of tissue, emigration of bloodc-orpuscles, the forma-

tion of pus, and swelling of the parts,—such conditions as never attend excementosis.

In conclusion, let us sum up what we have found:

1. We have found that the alveolo-dental membrane is not identical with periosteum. It is like periosteum in that it exists in two layers; but in case of the root-membrane they are *separable* layers, as demonstrated in tooth-extraction. Periosteum has no layer of straight parallel fibers like the layer next to the cementum.

2. We have found that the two layers have not the same origin,—the one originating in the osseous system; the other originating in the dental follicle.

3. We have found that they differ in their structure,—that the layer next to the cementum, after the parting of the fibers into a fine reticulum for the accommodation of the cementoblasts, is conspicuously blended into a band of nearly straight parallel fibers pursuing an oblique direction until they reach the central portion, or the line of contact with the other layer, and here they are brought by a gentle curve into a line parallel with the outermost and innermost surfaces of the membrane; that by this loss of their obliquity we lose the evidence of their continuance through to the other side of the membrane and their union to the walls of the alveolus; that the membrane next to the walls of the alveolus conforms in its structure to that of ordinary periosteum; that they have strongly-marked histological differences.

4. We have found that they have different functions,—one being the organ of formation of the bone constituting the socket, and the other forming the cementum, and it is claimed by no reliable authority that these two tissues are identical; that the most that can be said is, that the cementoblast cell is a modified osteoblast.

5. We have found that they have different sources of nerve and vascular supplies,—that as nerves and blood-vessels have never been traced passing through from side to side, it is a case of the highest probability that the *different* sources of vascular and nerve supplies from opposite directions is a physiological necessity, because of the dual character of the membrane.

6. We have found that pathology points to the same facts,—that the difference in their susceptibility to diseased action, as in cases of excementosis (no cementitious union ever being formed between the root of the tooth and the bone of the socket), proves that the membranes covering these hard tissues respectively *are not under the control of the same nerves*, and are not supplied by the same blood-vessels.

7. We have found that the rapid and almost universal healing by absorption, without exfoliation, of the alveolar processes after the wound of extraction, gives the strongest possible evidence that the alveolar socket is lined with a membrane *after* the operation, which, with the membrane covering the root, amounts to demonstration of the duality of the alveolo-dental membrane.

Thus surgery, pathology, and physiology are found in harmony with each other demonstrating the same fact.

In this examination of the nature of the alveolo-dental membrane I make no claim to original investigation; I am not a microscopist; I have made use of others' eyes and of others' microscopes, and have trusted to what they have revealed. I offer the advantage of the same eyes and the same microscopes to you, and ask you what you see,—unity, or duality?

SECTION VI.

Pathology, Therapeutics, and Materia Medica.

Report by A. W. HARLAN, Chairman.

THE discoveries of the past year in dental pathology are not sufficiently numerous to warrant even a summary of the contributions in this special field. The most important, the work of Miller, either through lack of interest in strictly scientific investigation or failure to comprehend the vastness of his labors to elucidate the causes of dental caries, has not yet been entirely accepted by the mass of the profession.

The next most noteworthy contribution in the field of pathology has been the one which attempted to foist on the unsuspecting and guileless practitioner actinomycosis, or "lumpy" jaw, in the human subject. At least two cases have been reported during the past few months of ordinary alveolar abscess which were gravely declared to be "lumpy" jaw, and similar to that observed in cattle. Expert microscopists, after examination of the contents of the swellings, declared the micro-organisms to be veritable actinomyces.

A very exhaustive paper reviewing the work of Israel, Zollinger, Virchow, Duncker, and others accompanied the report of the first case. The second case, after the extraction of the tooth, recovered without any treatment, showing that lumpy jaw in the human subject need not necessarily be fatal, even though actinomyces be present in the pus of an alveolar abscess. In both cases the teeth were carious and unfilled, and, as has been shown by Zeigler and others, the actinomyces are almost constantly present in the mouth, air-passages, throat, intestinal canal, and elsewhere. It were the simplest and easiest matter in the world for this organism to be found in the pus taken from an alveolar abscess without a fistulous opening. Actinomyces have been found underneath the gum overlying an erupting wisdom-tooth without producing so-called "lumpy" jaw. They are

instantly destroyed the moment they are exposed to free oxygen, and may, in consequence, be styled anærobic germs. The interest which these pseudo cases of actinomycosis have for dentists is this: Pus taken from blind abscesses should be examined under the microscope to discover if actinomyces are constantly present or only when the crown and root are unfilled; the organisms will not be found in the pus from a fistulous abscess.

Other papers, reports, and discussions on dental and oral diseases have failed to invite criticism or summarizing, on account of the paucity of ideas contained therein. The work which I have imposed upon myself in an investigation of the pathology of pyorrhea alveolaris is still unfinished, and I shall have to beg, as committees are wont to say, for further time.

In the domain of materia medica and therapeutics more activity has been shown, and the mass of the profession is gradually being weaned from the empirical use of only one or two remedies, and availing themselves of a more extended and useful knowledge,—a wider selection from materia medica. Although former years have given us the uses of a numerous list of drugs, yet none have created such a widespread interest as cocaïne. It is hoped that a full discussion of its merits and failures will take place here. Having used it in all operations on the mouth and teeth, especially in the extraction of pulps and as an obtunder of sensitive dentine, I have come to the conclusion that we have a vastly more efficient remedy in the stronger tincture of cannabis indica, or the normal liquid (an extract), for such purposes, than any form of cocaïne with which I am acquainted. A tincture of the strength of ℥x of the flowering tops to alcohol Oj is sufficiently concentrated to obtund, in from three to five minutes the most sensitive cavity in a tooth. The cavities should first be washed with tepid water to remove all débris, and the gums adjacent to the teeth to be operated upon painted with the fluid extract or tincture a minute before adjusting the rubber-dam. A clamp or ligature can then be adjusted without pain. I have removed the pulp from a tooth painlessly after saturating it with the stronger tincture in from five to eight minutes. The tincture of cannabis indica was first used in England about one year ago by Mr. Aronson to obtund the gums before extracting a tooth. It was used very much diluted in warm water; the gums were saturated by painting them; then the beaks of the forceps were warmed and dipped in the diluted tincture, and the patient was said to have felt no pain. My experience with cannabis indica

has been as an obtunder of sensitive dentine, exposed pulps, and by injecting a weak extract into pyorrhea pockets previous to removing deposits from the roots. I have been unable to obtain good results by using cannabin, the active principle of cannabis indica. A patient should not be allowed to swallow a very large dose of the above tincture or fluid extract, as these proportions are about three times stronger than the ordinary tincture or extract. The antidote is the same as for opium.

Your attention is called for a moment to a consideration of resorcin and tereben, both antiseptics of great value to the dental surgeon. Resorcin is no new drug, as experimental therapeutists would testify; but its merits are little understood by dentists, and its use has been limited, even in general practice. It may be used in all conditions where carbolic acid has been indicated without the danger of the latter, as it is neither poisonous, except in very large doses, nor escharotic, except when used in crystals or powder. Tereben is the active principle of the oleum terebinthinæ, and has for composition C_{10} H_{16}. It is a transparent, limpid liquid, with no unpleasant odor or taste, and is a ready absorbent of oxygen. It is disinfectant, antiseptic, and stimulant. It may be used in and around the roots of teeth for all the usual purposes of disinfection and stimulation, and is especially useful for the destruction of anærobic germs, such as are found in closed abscesses. It is not an obtunder of sensitive dentine, and is not used as a dressing for exposed pulps. It will destroy the foulest odor which proceeds from the decomposition of a pulp. It does not irritate the most sensitive surface, and it is especially useful as a dressing for root-canals when they are particularly mal-odorous. It dissolves readily in all the essential oils, and is a solvent for gutta-percha, iodine, various resins, and is soluble in alcohol, one part to ten. Its merits in the above-mentioned cases are undoubted, and a few trials will convince the most skeptical of its great efficiency.

SECTION VI.—Continued.

The Catarrhal Nature of Pyorrhea Alveolaris.

Paper by J. D. PATTERSON, of the Section.

THE especial object of this paper is to present the study of the comparative pathology of pyorrhea alveolaris and catarrh. The subject is one of absorbing interest, and the establishment of identity of character between the two diseases will aid in arriving at a more scientific method of treatment of so-called pyorrhea alveolaris.

The mucous surfaces are ever under suspicion of certain characteristic diseased conditions. These conditions vary in different territories of mucous surfaces as the anatomical form and structures vary. The mucous surfaces lining the respiratory tract are especially subject to a disease commonly called catarrh. The classical seat of catarrh is in the nasal passages; it also extends to the pharynx, the larynx, to the trachea, and to the bronchial tubes. The catarrh of the nasal mucous membrane being the commonest form, we will therefore observe its pathology to the exclusion of other catarrhs. As the result of repeated attacks of cold, or as a chronic affection from the outset, or from irritation from dust or spores in the inspired air, we find the mucous membrane taking on an inflammation, and the prominent symptoms are, first, a phlegmonous appearance, swelling of the membrane, a profuse serous effusion, which excoriates the healthy parts over which it flows.

The next stages in the pathology of catarrh are marked by change in the character of the exudation, which, at first watery, now becomes filled with pus-corpuscles, and sometimes with blood-corpuscles, both red and white; the swelling increases, and hyperplasia of the membrane is exhibited. At this stage, and in its further progress, the disease is extremely infectious. The adjoining healthy parts are quickly invaded by the exudation from the diseased surfaces. The pharynx and larynx are especially subject to contamination because of their anatomical relation to the nasal passages.

The subsequent course of the disease gives rise to numerous complications. The atrophic form rapidly ensues; this results from destruction of function in the mucous membrane. Then crusts are formed, an ulcerative process is developed under the crusts, hypertrophy is present, and decomposition, with ozena, follows. Under the condition of hyperplasia found in the progressed disease are seen new formations and polypoid excrescences. The ulcers sometimes penetrate deeply and, after destroying the periosteum, produce caries. Catarrh may also invade the neighboring parts. It extends posteriorly into the pharynx, anteriorly to the epidermis and the cavities of the upper jaw. The ulcerative process under the crusts throws out chalky deposits and leads to bony formations.

Turning to the first symptoms of pyorrhea alveolaris, we find the festooned gum-edges are under an irritant; the ligamentum dentium is rapidly destroyed, loosening the gum from the tooth; the loosened gum weeps out a serumal effusion; there is increased presence of ropy saliva, and inflammation, not always indicated by redness. Next in order to first symptoms, we find increased tumefaction, a purplish tint of the gums, increased redness and congestion. The exudation has become purulent, filled with pus-corpuscles, and it burrows in places where the ligamentum dentium is destroyed. The teeth, partially deprived of their support, are frequently changed in position, protrude from their sockets, and are tender to the touch.

In further complications in pyorrhea alveolaris we find the pockets about the teeth becoming deeper; the septum of alveolar process between the affected teeth is blunted and finally absorbed, as are other territories of the process opposite the deepening and extending pockets, the destruction of the alveolar edge being greatest where the wall is thinnest. In these later stages, and sometimes early in the disease, deposits are formed upon the roots of the teeth, sometimes in considerable quantity, and again in jagged, cactus-like points, and the whole invaded tooth-surface is bathed in pus. Unless resolution comes under treatment, the attachment of gum and process to the tooth is destroyed, and the tooth under movement of food or lips drops from its socket.

Thus, in brief, is described the comparative pathology of catarrh of the respiratory tract and of the disease we have denominated pyorrhea alveolaris. In the description of catarrh nothing is set down save upon the high authority of Ziemssen's Encyclopedia (see volume upon "Diseases of the Respiratory Organs"); also the work

upon "Diseases of the Nose and Throat," by Dr. F. H. Bosworth, a celebrated specialist of New York, and these authors will be cited where other reference is made to catarrh and its general pathology further along in the presentation of this subject.

Your careful attention is now directed to the similarity of pathology in these two complaints in the following particulars:

1st. The similar appearance of the affected mucous membrane in both diseases, and in the various stages of each.

2d. The identical character of the effusions. First, serous, containing numerous epithelial scales; then becoming filled with pus-corpuscles and blood-corpuscles.

3d. The infectious nature of both diseases. Text-books all agree that catarrh is not only contagious, but sometimes even epidemic. The contagious nature of pyorrhea alveolaris is well-known to careful observers. From the gum or one or two teeth it rapidly contaminates the neighboring parts until the mucous membrane around each tooth is affected.

4th. The burrowing of pus, similar in each trouble.

5th. The tendency to destruction of periosteum and the underlying bone.

6th. The similar deposits thrown down in both diseases. It is scarcely necessary to again call attention to the fact of deposit accompanying pyorrhea alveolaris. It is so well known and so frequently encountered that all are familiar with it. It is not, however, generally known that accompanying catarrh there is also a deposit, thus forming a strong point of similarity in pathology with the other disease. In the volume of Ziemssen, before referred to, we find the following upon the complications of catarrh:

"The fluids retained may throw down chalky deposits, and thus form bony concretions" (page 141). * * * "These deposits are of variable hardness, and usually consist chiefly of phosphate and carbonate of lime. The mucous membrane of cavities contiguous to the nose, particularly of the sphenoid bone, is especially liable to this change, but the membrane covering the turbinated bones may, too, be affected, developing, first, fine granular points, and afterward plates of calcareous matter."

The character of these deposits, and the manifestations of disease preceding their formation, point strongly to the conclusion that they are similar in origin to the deposits which are found in pyorrhea alveolaris.

In the literature of catarrh we do not find that the oral cavity is

liable to the affection, but that catarrh is confined to the air-passages proper. We find, however, that all territory towards the lungs and esophagus is rapidly affected by the contaminating discharge. While, from continuity of structure, the trachea and bronchial tubes are poisoned by a slight drainage, and much of the discharge necessarily passes innocuous into the stomach,—yet a large quantity of the discharge drips into the mouth from the nares, and is returned to the mouth from the throat by "hawking" to mix with and poison the sputa. Granting its presence in the mouth, let us recall its infectious character, its liability to attack mucous membranes, and its known tendency to destroy periosteal attachment between bone and tissue; then place the facts side by side with the too well-known fact that a disease is common to the oral cavity whose pathology we have shown is coincident with that of catarrh, and what is the logical conclusion? Shall we not, instead of searching for constitutional anemia, or an ossific diathesis, first follow the readier tracings of local contamination?

Besides, a catarrhal condition of the mouth may originate in that cavity, and not be due to infection at all. If the oral cavity is used as an air-passage in the pernicious habit of mouth-breathing, then we have all the factors presented for causing the disease without asking its presence in the nasal passages.

The mucous membrane at the festooned gum-edge is peculiarly liable to attacks of morbific agents; for in studying its anatomy we find it here presents numerous fine papillæ. The concavity presented at its union with the tooth also affords ready lodgment for irritating fluids, as we well know.

In thus briefly presenting the catarrhal nature of pyorrhea alveolaris to your consideration, the work of this paper is completed. No unjustifiable theories have been presented, but only well-established facts, from which a comparison of the two diseases has been made. Your attention is invited to the practical demonstration of identity, which can only be made from careful study of both complaints in all their history, and supplemented by your clinical records.

Concluding, I desire to say that I should not have ventured the foregoing observations had I not, after careful observation, become convinced of their value. My clinical experience during the past year, which embraces the time my attention has been given to the catarrhal nature of pyorrhea alveolaris, covering a record of some twenty-four cases, is as follows: Catarrh of the nasal passages,

or of the pharynx and larynx,—generally combined,—*in every case;* in ten cases, the atrophic or fetid form; in a majority of the cases breathing conducted almost entirely through the mouth, on account of stenosis of the nasal passages. In many of the cases catarrh was stoutly denied, but upon careful examination was found to be present.

Whatever the future may develop in the study of the causes of the disease we call pyorrhea alveolaris, and whatever personal observation may teach that differs from the past, yet these recent observations from my own practice have been an astonishment which has been uninterrupted by the testimony of any case presented for treatment during the period mentioned. The actual demonstration of the identity of these diseases must be left largely to the competent ability to diagnosticate the catarrhal presence. This ability cannot be made available without considerable study. The observer will find at the outset many difficulties. The history of catarrh is not yet very clear; the etiology is somewhat in dispute among those high in authority. The actual irritant in the catarrhal exudation is also a mooted question. Then, the history from the patient is often misleading. Those suffering from the disease will sometimes deny until denial is useless that they suffer from catarrh, and not until the atrophic, hypertrophic, and fetid forms are present will they admit the truth. It is not an infrequent occurrence in any dental practice to detect the peculiar catarrhal odor known to you all (and said by Dr. Bosworth to faintly remind of crushed bed-bugs more than anything else), and yet to find the patient professedly ignorant of the least trace of catarrh, and, if admitting anything, he will relegate the trouble to a simple "coryza." These and many other difficulties confront our investigation; but if with care we can arrive at some fixed point in the etiology of dental disease, our labor will be well repaid.

SECTION VI.—Continued.

Pyorrhea Alveolaris.—Sponge-Grafting as related thereto.

Voluntary Paper by W. H. ATKINSON.

TRUE diagnosis is the first prerequiste. There can be no real pyorrhea alveolaris without loss of attachment of the dentium ligamentum, superficially or deep into the socket. Flow of pus is always evidence of failure of first effort of the system to produce new tissue to take the place of that which has been lost through traumatism or mal-nutrition, singly or in combination. Pyorrhea is cured by destroying the microbes which prevent the formation of new tissue by first intention,—regular granulation as it is called. That arising from mal-nutrition is cured by rectification of the constitutional and local conditions which precede and accompany the diseased acts.

Imperfect elimination of urea is the principal constitutional antecedent of pyorrhea. This form is only *palliated* by local treatment.

Traumatic pyorrhea is resultant upon the presence of foreign bodies in the alveoli, such as bones, splinters of wood, or misplaced teeth, or parts of fractured teeth and bones; and is cured by removing the foreign body and securing a sterilized pocket for the new growth.

Calcareous deposits are never the cause of pyorrhea, and but seldom even concomitant with the malady properly so classified. Nevertheless they should be removed and prevented from re-forming by proper cleanliness.

Pus, sanies, and ichor are products of microzymes capable of destroying the pabulum brought to the seat of lesion for repair. Many parasiticides are capable of destroying these microbes.

Escharotics not only destroy the bacteria, but also convert the pabulum and soft tissues into a sort of scab of "cooked flesh," of a density commensurate with the strength of affinity between the remedy and the protogenous mass, with which it combines by what

has been called chemical affinity. Wherever this pellicle is insoluble in the solution which produces it, the production of microbes from the outside is prevented, and the scab now supplies the "sterilized pocket"—"utricle"—in which normal tissue of the part will form.

Nitrate of silver has long been known as able to afford this kind of protection to granulating surfaces by supplying the outer wall of the "utricle"—"pocket." In good constitutions non-sterilized pockets may continue to discharge those products of the killed pabulum,—pus, sanies, ichor,—for indefinite length of time, often during life of the subject.

For constitutional treatment, correct gymnastic exercise, tonics, and alteratives are to be resorted to, viz.: exercise just short of fatigue, bathing, and regular rest in sleep of eight hours per day; as a tonic, sulphate of cinchonidia, four to six grains per day in two or three doses of two grains each, persisted in until the blood column is in full supply of cruorin (hemaglobin).

For local treatment, three principal remedies are preferred, viz.: elixir vitriol (full strength), aqua regia (one part to seven of distilled water), and a caustic paste made of crystallized carbolic acid and caustic potash rubbed into a paste of equal quantities in a glass or wedgwood mortar, *without water*. This last is now known as the "Robinson Remedy," when made with water. These remedies, with many others, are capable of meeting our necessity in these cases.

The great obstacle to correct practice among all sorts of healers is the lack of knowledge of the principles of molecular changes and the manner of their presentment in health and disease.

The principal incitement to write papers on professional topics is to so state the facts of diagnosis and application of remedies that have led me safely as to enable others to profit by my experience. The stages of loss of the attachments of the teeth to their sockets will be met by the use of the remedies in the order here named, viz.:

Where slight recession is present and little or no discharge perceptible, use elixir vitriol in the little recesses; where the loss of attachment is greater, and accumulations of food, microbes, soft or even hard lime-deposits occupy the recesses, use aqua regia; where the loss is greater still and the gums dark, swollen, and discharging pus, sloughs, and bloody serum, then resort to caustic paste, being nice and careful about seeing that it touches *only* the depth of the pockets and their margins without flowing over on to the membrane, and especially the lining of the cheeks and lips.

In the whole history of surgery there is no method of so much value and so little understood and practiced as that which has been called sponge-grafting. Like most of the knowledge of principles and modes of practice in our specialty, it grew out of the misfortunes of traumatic or functional lesion. The first use made of sponge-grafting in a crude way was by obstetricians, to fill the gap of cervical fissure of the uterus resulting from violent and tedious labor. I remember the discussions as to what became of the sponge. In one case, of a very nervous woman, then called hysterical, it was questioned whether she did not purposely remove the sponge, although she stoutly maintained the contray. The cases submitted to this treatment did so well that the method was kept secret among a few for years. At that time a solution of bichloride of mercury in water, alone, or with sal-ammoniac, was the external remedy used for scabies (the itch). Dr. Wm. Woodruff, of Meadville, Pa., at the suggestion of a pupil then studying with him, wrung out a sponge in this solution and used it in a badly torn cervix uteri following labor, which healed so kindly as to induce him to adopt it in the general treatment of these lesions.

The tediousness of the drainage method of healing large loss of tissue by fibrous tents, rubber tubes, or horse-hair or other setons, to induce granulation, is greatly abridged by the use of a sponge-graft in place of a tent, which tent must be removed before the wound can be closed completely by the new growth.

Efforts to assist nature in healing wounds and in reproduction of lost tissue from traumatic lesion, or from functional lesion, had been so various, bungling, and inhuman, that it is no wonder that a mere *expectante* course long held dominion in the annals of surgery. From the abhorrent use in surgery of *the actual cautery* in the shape of boiling oil (into which the bleeding stump was plunged), and red-hot iron and embers applied to bleeding wounds, and the *potential cautery* in the shape of the strongest alkalies and acids to arrest hemorrhage, the "wait and watch" treatment was established. The lack of any just apprehension of the process of inflammation permitted the introduction of "irrigation" and "drainage" of wounds and abscesses as helps to "granulation," as healing of suppurating tissues was then called.

Healing by "first intention" has always been regarded with high favor. Every method and management conducive to this form of healing must be of the highest importance. Transplanting bits of skin and bits of epithelial tissue led to such kindly results as to

suggest the introduction of some receptacle in which the blood-plasm might be received and held in place to form a clot in the gap of the wound, to be metamorphosed into the scar-tissue taking the place of the lost substance.

Many forms of animal sutures and of flesh tents were resorted to, especially fibrous tissue in the shape of tendons. At length sterilized tents were introduced, which were gradually extruded as the new formations progressed in the depths of the wound, and had to be cut off, from time to time, until at last a mere shred remained in the pit left at the site of the former wound-tract. Sterilization, now known as "Listerism," is a great step in advance of the old filthy method of uncleanly carelessness.

The accounts of chicken's flesh and other forms of non-human animal flesh being used to fill gaps of lost tissue may be dismissed with the verdict of "not proven." The accounts of the use of sterilized sponge on the other side of the Atlantic led me to try the method in my own practice. The results have been so favorable as to induce me to write this paper, with the hope of having my brethren become partakers of the benefits of the simple and beneficent device.

Take a case where a portion of the flesh has been quite removed by bite of a dog, cut with knife, buzz-saw, or other free-cutting instrument. It is only necessary to staunch the bleeding and fit a bit of sterilized sponge of the size and shape of the lost flesh and cover it with some impervious dressing, of oiled silk, sheet rubber, court plaster, gold-beaters' skin, Husband's plaster, or such like, over which a light support, without pressure, should be secured to keep the exudate of blood-plasm from escaping too freely. When this is done in a healthy subject we may look for union by first intention, without one drop of deteriorated pus or other aberrant product of the albuminoid clot which fills the cavity, and out of which the new growths of tissue come.

Destruction of all disease-germs which adhere to the dressings constitutes the sterilization or Listerism which proves so conducive to healing by first intention. A large number of germicides are at our command, which are competent to effect sterilization. The chief one and leading the list is a solution of bichloride of mercury, of from one in five hundred (1 in 500) to one in a thousand (1 in 1000) parts of distilled water.

Sponge-grafting conserves the time and energy of the healing process. The former manner of determining the point at which to

cease dressing was to place the finger upon the new growth. If the plasm broke short without adhering to the finger and forming a more or less tenacious rope, which broke as the finger was carried away further and further, it was deemed necessary to continue stimulating dressings. But if the rugæ of the finger left their imprint upon the jelly-like mass closing the wound, it was deemed better to simply protect it from outward disturbance by a simple non-irritant dressing. If the plasm was so watery as to not rope at all, dressing with some coagulant was advisable.

With the old training to guide us, and the present better understanding of the character and steps of the inflammatory process, we are more able to discriminate the indications of favorable progress and unfavorable regress of the healing processes.

DISCUSSION.

Dr. Abbott: For some two years or more, I have been using a spray instrument for the treatment of abscesses of the antrum, alveolar abscess, teeth where they need antiseptic applications, and in pyorrhea alveolaris. I have quite a number of points that I use for the purpose; I simply introduce this here to show the method of application. It is an excellent means of applying remedies for nasal catarrh, or any catarrhal inflammation of the mucous membrane of the pharynx or larynx. If it is desired to apply any antiseptic where tartar has been removed in cases of pyorrhea alveolaris, we take a small instrument with a fine gold tube which can be passed as far below the margin of the gum as you desire, when, by turning the spray on, the remedy is driven into every possible recess. In treatment of abscesses of the antrum it is necessary to have medicine applied to every portion of the cavity. In an hypertrophied condition of its mucous membrane there are frequently layers of it, from top to bottom, in the folds of which pus is often found. To cleanse these thoroughly by the ordinary methods is very difficult, but this apparatus overcomes the difficulties, as with it the remedy is carried in every direction and to every remote point. Any remedy which does not crystallize too rapidly can be used with the finest of these tubes. Pure "Listerine," which crystallizes very rapidly, would stop up these instruments in a very short time, unless they are kept washed thoroughly with water. In fact, these fine tubes should be washed out with water spray every time they are used; any remedy may be used, as long as it is in liquid form and capable of being thrown with a spray instrument.

This instrument is made by a German by the name of Charles Beseler, 218 Centre Street, New York. I expect the instrument will be placed on the market by another house soon. It will then be made more perfectly, *i.e.*, the spray-points will all be made alike and of the same size, the air-receiver will have a thermometer, so that if it is desirable to have the air heated, the degree can be noted. This receiver will sustain fifty pounds' pressure, which is increased but slightly if heated to 120° F.

Dr. Marshall: I would like to ask Dr. Atkinson a question in regard to sponge-grafting. He speaks of protecting the graft after it is put in. I would like to have him explain how he protects it in the mouth, where he wishes to reproduce tissue around the root of the tooth?

Dr. Atkinson: If in case of loss of substance by pyorrhea or any other mode of sloughing the teeth are loose, you must tie them with silk ligatures; if they are too long to make the occlusion as you want it, trim them off until you get the occlusion where it will bring each tooth into such position as to do its modicum of use in the mouth, and distribute the force as uniformly as possible. Then take an impression, pour the plaster into the impression, and get a cast. You will see where the tissue is missing. Build that up with wax, plaster, or composition, a little higher than you want your new growth to come, so that there will be an opportunity for a little bit of shrinkage when the apparatus is removed. After you have done that make a die, and strike a thin piece of platinum so as to make a perfectly tight pocket that will be turned delicately down wherever the irregularities or loss may be, and also fit to the tooth sufficiently tight to prevent anything entering. You will have to make one for the inside and one for the outside and tie them together in place. That is the best protection for this particular class of cases. Where the tissue is lost by sloughing, by tumors, by any kind of enlargement of the neighborhood where the morbid tissues have pushed the tissue out of the way, if you have too much skin to make it right, take the excess of skin off, so that it will collapse and close the cavity, after removing everything of the character of morbid growth, and have your sterilized sponge cut as near as possible to the shape of the chamber, so that it will not press too much and not press too little.

Now, I want to say, after answering your question, that I have not been able to detect scar-tissue in a gum where tissue has been reproduced. There was no difference of the tissue from the

original gum, and I do not feel satisfied to call it scar-tissue; I call it reproduced tissue. If it be scar-tissue it is scar-tissue A No. 1. It is very important to get proper sponges. Get surgeons' fine sponges anywhere in a good drug-store, see that they are perfectly free from all foreign elements, and put them in a sterilized solution made after the manner that I described in the paper. I make it with one grain of bichloride of mercury and one ounce of distilled water, raised to 130° Fahrenheit. I will give you my reasons for that. At 133 albumen begins to coagulate, or fibrilate, a little, up to about 163 or 164; if it goes beyond that it becomes cooked, so that it is not fit to be wrought into tissue. If the sponges are boiled they will shrink, and as soon as the sponge begins to shrink you kill the very material that is converted into tissue, or is capable of being absorbed.

Dr. Marshall: My attention was first called to this subject, a year ago last May, by a paper read by Edward C. Briggs, of Boston, at Washington, before the Section of Dental and Oral Surgery in the American Medical Association. He had met with the same difficulty that I think most of us have met with in our attempts to use the sponge-graft, viz.: that it often became displaced. I should think the suggestions that Dr. Atkinson has made with regard to the method of protecting it are good, and I have no doubt I shall be able hereafter to succeed with sponge-grafting.

Dr. Briggs, in his paper, advised the preparation of the sponge after the formula which was recommended by a St. Louis surgeon, Dr. Edward Borck. He was in the habit of placing his sponge in dilute hydrochloric acid, to dissolve out all the earthy salts, and then to treat it with ether and iodoform; but I found that sponges treated in that way and then excluded from the air, would very soon shrivel up and become soft and good for nothing, and consequently I stopped right there. But when I go home I shall try again, with the suggestions given by Dr. Atkinson.

Dr. Briggs suggested that certain forms of cleft palate, or rather perforations of the palate from accident or specific disease, might be treated successfully by sponge-grafting, and it seems to me perfectly practicable that all forms of clefts in the hard or soft palate should be thus treated.

I want to say a few words upon some of the other points brought out in the report of the chairman of the Section. First, with regard to the remarks of Dr. Harlan, in his comparisons between cocaïne and cannabis indica. Since the doctor called our attention to the use of cannabis indica for obtunding sensitive dentine, I have been

experimenting with it, but so far I have not been able to get the results that I get from cocaïne. There is one fact regarding cannabis indica which I fear will make it a very uncertain drug to use, namely,—it is claimed by pharmacists and physicians that it is a most unreliable drug. You may make preparations from what appears to be the perfect flower, and when you come to use it the results are *nil*, while another preparation may operate beautifully. The majority of physicians have laid it aside from that fact, and I apprehend we shall find the same difficulty when we come to use it as a local anesthetic in the mouth. When the active drug can be obtained I am inclined to think we shall get good results. I applied some of this preparation that has been passed around,—prepared by Parke, Davis & Co., of Detroit,—to the tongue and the mucous membrane of my mouth, but could get no results from it. I attempted to use the tincture recommended by and made expressly for Dr. Harlan, by Sargent, of Chicago, for obtunding sensitive dentine; in one case in which I gained no result, so far as obtunding the sensibility of the tooth was concerned, the patient told me at the next sitting that for thirty-six hours afterwards he had a peculiar benumbed sensation in the cheek and gum. But in its effects upon sensitive dentine I have not found it as satisfactory as the citrate of cocaïne.

With regard to pyorrhea alveolaris, I have seen a great many cases which I could not attribute to local causes, and I am of the opinion that many of these cases were of constitutional origin. The English view in regard to it is that it is the result of a rheumatic or gouty diathesis. I have seen cases in which patients were suffering from diabetes mellitus, and Bright's disease of the kidneys also, in which all efforts at local treatment had failed to cure the pyorrhea until they received constitutional treatment by the physician, and when the symptoms of the diabetes or the Bright's disease were mitigated there was an improvement in the pyorrhea alveolaris. I can mention several cases affecting ladies, who had also been troubled with uterine difficulties, and in which all local treatment had been unavailing. But when they were turned over to the gynecologist, and the uterine displacements had been corrected, and the inflammatory conditions reduced, there was great improvement in the local conditions in the mouth, and in three cases which have come under my personal observation they were cured without any local treatment whatever. As soon as the system was put in a healthy condition, there was a subsidence of the pyorrhea alveolaris.

Dr. Davis: My experience with cannabis indica has been quite

the opposite of Dr. Marshall's. The day following the reading of Dr. Harlan's paper at the last meeting of the Chicago Dental Society, I purchased some of the tincture prepared according to his formula, and have tried it in almost every case of sensitive dentine that has come under my notice since, and in *one particular case* where I had used the cocaïne last November without success I found cannabis indica to produce very marked results within five minutes from the time of applying it. The case—one of those that usually give us so much trouble—was caries of the lower incisors, around the gingival margin. The patient, who was of a very nervous temperament, was not informed that any remedy was being applied, and to prevent her taking any notice of it, and thus allow her imagination to play an active part, I busied myself arranging the rubber-dam and drying out other cavities. The result, from a five minutes' application, was entirely successful, and like results were obtained in the remaining cavities.

I have since used the fluid extract (officinal) in obstinate cases, and have yet to experience my first failure with the drug as an obtunder of sensitive dentine. In extracting, I have applied it for twenty or thirty minutes, both the tincture prepared according to Dr. Harlan's formula and the fluid extract, but without any favorable results.

Dr. Abbott: I would call attention to two other purposes for which this instrument can be used: one is for a chip-blower, and another is for producing local anesthesia.

Dr. Taft: I would suggest that it could also be used with a warm-air blow-pipe.

Dr. Abbott: It can be set with a lamp under it kept burning all the time, and may be used for that purpose.

Dr Thompson: During the progress of Dr. Patterson's investigation of the catarrhal nature of pyorrhea, I was also making observations and reporting to him. There are some cases that I recall, one particularly, of a young man, a printer, who had allowed his teeth to get into a bad condition. He had for some time been seriously affected with catarrh, although he had never been treated for it. I directed him to apply to a physician, but he declined to do that; and I then directed him to use a douche, with the ordinary solution of salt for cleansing his nose, which he used with some benefit, and in the meantime I treated the pyorrhea simply by cleansing and astringents, and in a short time both the pyorrhea and the catarrhal condition showed marked improvement.

Bleeding of the gums often occurs in pyorrhea, and is one of the most marked indications of its catarrhal nature, as this is nearly always accompanied by catarrh of the nasal passages. To some persons I have suggested the possibility of catarrh being present when there was pyorrhea, and upon consultation with physicians have found that such was the case. Some time ago I witnessed a clinic of Dr. Templeton, of Pittsburg, who is an advocate of the use of copper sulphate, or common blue-stone, of full strength, which he pulverizes and applies directly in the pockets in the gum in the treatment of pyorrhea. He claims to have had wonderful success with the remedy. He makes applications about once a week, in the first instance, and follows it up with astringent and healing washes.

Some time since I conceived that pyorrhea might be indicative of renal disease, and in cases where I suspected such disturbance, directed the patients to consult their physicians. Sometimes slight trouble in that way was found, but not frequently enough to make a theory; and when in later cases which had diabetes very decidedly I found there was no pyorrhea, but only an ordinary amount of calculus, I was forced to abandon that notion. Then I began to notice its catarrhal nature, and I am now convinced, through Dr. Patterson's investigations, that that is the correct theory of the disease; and that if it is studied and treated from that stand-point we shall have greater success in its treatment.

In the use of cocaïne, I have met with some successes and with some failures, but I found that it required too much time to be used as a constant remedy. I think that it is reliable, but the time required makes it impracticable for ordinary purposes.

Dr. King: Having given considerable attention to the treatment of this disease during the past eight years, I desire to say a few words and read a few cases from my record of those treated. My theory is that calculus is the immediate cause, first producing inflammation of the gums and peridental membranes, and finally absorption and suppuration.

The theory that pyorrhea is a constitutional disease, or the result of an impoverished condition of the blood, in my judgment, cannot be sustained by a reasonable symptomatology or the facts so plainly present in the cases themselves. Many of the cases which have come under my observation have been patients of general good health, many of them robust and vigorous, either in prime of life or but little past. In refutation of the theory that this disease comes of an impoverished condition of the blood, I will cite a few cases from my record.

1st. Mr. D., aged thirty-one years; general health, good; occupation, druggist; number of teeth in the mouth twenty-six, all more or less diseased, many of them quite loose; exudation of pus from gums quite general; usual accompaniment of calculus; absorption of the alveolar process quite extensive; patient attributes the cause to mercurial salivation while being treated for bilious fever some fifteen years previous.

2d. Mr. J., age forty-six; says, "I was never sick a day in my life—" which is corroborated by appearances, he being robust and ruddy, and weighing one hundred and eighty pounds; six teeth gone, victims of this disease; the other twenty-six badly affected.

3d. Mrs. M., "fat, fair, and forty;" has enjoyed excellent health through life; never had any sickness save that incident to maternity; all of the teeth in position, and nearly all affected by the disease—one so badly that I removed it. There was no sign of caries in any of the teeth excepting two or three small fillings, which were inserted many years ago.

4th. Miss S., age about forty-five years; was never sick in her life, never employed a physician nor took a drop of medicine, pill or powder; twenty-two teeth in position, the others lost through this disease; all remaining ones more or less affected, two entirely without osseous support; a slight deposit of sanguinary calculus present.

These four patients have been selected out of the twenty-three treated as the most perfect in their physical condition, and I think show an average per cent. of such found among an equal number of average humanity not afflicted with the disease in question.

Now, if this disease is not the result of salivary deposit, why is it that those theorists who deny it are so particular to instruct their patients as to the care and cleanliness of their teeth, lest the disease return? And why are those who hold to the theory of salivary calculus being the cause successful in curing it by simply surgical and local treatment?

True, not every case of pyorrhea, when brought to the notice of the dentist, is accompanied by salivary or serumal deposit, but nine patients out of ten of these will tell you that the beginning of their trouble was tartar upon the teeth. Why is it not found there now? Because some systemic change has taken place by which these salts are no longer a product of the saliva.

"The foe though gone, his track is here,
Behold the wound where thrust his spear."

Dr. Ingersoll: Perhaps I may as well here as anywhere else correct a statement which has got into the journals a number of times, and recently from Dr. Rawls, of Kentucky, in the *Ohio State Journal*, on the subject of pyorrhea alveolaris. I have been quoted as saying that the cause of pyorrhea alveolaris is the gathering of sanguinary calculus on the roots of the teeth. Any one who will read my paper, published in the *Ohio State Journal*, on the formation of sanguinary calculus, will find that I distinctly stated that it is never the cause of ulceration but uniformly the result of it.

Dr. Friedrichs: I would like to inquire whether any of you have ever seen a considerable deposit of salivary calculus without its producing any irritation or pyorrhea? One or two cases have come under my eye,—one in which there is a considerable deposit. The subject is an Englishman who would not allow any dentist to touch his teeth. He said they had been in that condition for the last twenty-five years, and I could not see that there was any inflammation produced by the deposit, a shis gums below the deposit appeared in a normal condition.

SECTION I.

PROSTHETIC DENTISTRY, CHEMISTRY, AND METALLURGY.

REPORT BY WILLIAM H. TRUEMAN, SECRETARY.

IN the last report of this Section, we referred to a process of constructing dentures of vulcanite, in which the usual method of flasking and packing was dispensed with. The idea was culled from several articles in various English dental journals, which spoke of the decided advantages of the new process,—its cleanliness, the saving of time in construction, its safety to the teeth when the gums are ground very thin, and the decided advantage of absolute safety to the cast in cases where the alveolar border overhangs, or where from its shape it is liable to crush or break when the denture is flasked and packed in the usual way. The non-mutilation of the cast was also claimed as a marked advantage in difficult partial lower cases, and in fact in all partial cases.

A diligent search of the various dental journals published at home and abroad, and equally diligent inquiry of those supposed to be versed in such matters, failed to furnish the practical details of the new process. Recently, however, Dr. J. Spyer gave a demonstration in Philadelphia, of a process he has been using, that seemed to be identical with that referred to in last year's report, except that, after preparing the case for vulcanizing, he invests it in plaster in an ordinary flask; while in the English process the denture was firmly packed in finely pulverized steatite, or soapstone, and inclosed in an iron box, which took the place of the flask. The articles referred to also state that the soapstone was not injured during the process, but could be used repeatedly.

Dr. Spyer demonstrated the process in connection with an idea which he has invented and patented, and termed by him "Surface Cohesion Forms." These forms are made of tin foil, or some similar metal, or combination of metals, about the thickness of the tin foil

or "patent metal," now on the market and originally prepared for what is known as "stipple-work" in connection with the use of celluloid, and in general use for covering the cast in the ordinary manipulation of vulcanite to secure a clean, bright palatal surface to the denture. These "Surface Cohesion Forms" are embossed with a geometrical pattern somewhat like that impressed upon the foundation wax used by bee-keepers, but of a much smaller pattern. The pattern, we understand, is not important; the peculiarity, and the really important feature Dr. Spyer claims, is, that when the metal is stripped from the plate after vulcanizing it leaves a net-work of channels in the plate which all connect with one another, and thus instead of having a single suction cavity in the center of the plate there is produced a peculiar shaped one extending over the entire palatal surface. This, he claims, gives a much firmer adhesion, permitting a much smaller plate, with this additional advantage, that should the plate rock or tilt, from pressure brought to bear upon it when in place in the mouth, the suction will not be entirely lost as is usually the case with the ordinary central cavity, but will still be maintained under those portions of the plate not materially displaced. He also claims that there is less irritation to the mucous surface of the mouth. The use of these forms is not confined to vulcanite or celluloid. For gold, platinum, or other metal, the "cohesion form" is cemented to the palatal surface of the cast, molded in sand in the usual way, and the plates swaged up; an extra zinc die may be needed to swage the lines of the form sharply. The forms, for use with either metal or vulcanite plates, are fitted and shaped so as to be about one-eighth of an inch less than the plate, leaving a margin all around.

The new method of packing as demonstrated by Dr. Spyer is as follows:—

After marking upon the model the outline of the plate, and cutting or scraping the cast as may be desired to secure an accurate fit for the edge of the plate, fit a piece of thick tin foil, or of the "cohesion form," so as to be about one-eighth less in size all around the outline of the plate. Now, take the cement, made by dissolving the vulcanizable rubber to be used in making the denture in chloroform to the consistence of a thick syrup, and paint that portion of the model to be covered with the tin foil, and immediately apply the foil, carefully pressing it in place. The cement under the form filling the depressions on its under surface prevents them being crushed out of shape during packing and vulcanizing. (The forms

may be used in the ordinary method of packing if desired; in that case, be sure to get enough cement under the form to well fill the indentations, and use it a little thicker.) In a few moments the cement will be set; now paint the upper surface of the foil, and as much of the surface of the model as is intended to be covered by the denture, with the cement, and adapt to it a piece of vulcanizable rubber previously cut to the proper shape, working it into place much in the same way a wax or gutta-percha base-plate is fitted. On this mount the teeth; and instead of holding them in place with the usual wax cement, use the chloroform and rubber and small pieces of rubber, packing them well under the teeth and around the pins. With a little practice, we are informed, this is readily done. It is desirable to warm the rubber slightly, so that it will cohere, and to use a hot instrument in packing it into place. After the teeth are in position, add rubber to form the rim, and build the rubber to the desired form, shape, and size, making the surface as smooth as possible—in other words prepare it for the flask, using rubber instead of wax. When ready, imbed it in plaster in an ordinary flask, making no provision for opening the flask, as it is not necessary, and screw the cover on tight before the plaster is set. When the plaster is thoroughly set, it is ready for the vulcanizer.

We have examined a piece of finished work made in this way; except at a few unimportant points it was as well done as by the usual method. The saving of time and labor, and its cleanliness, are decided merits. Not being able to adjust the denture in the mouth before finishing to test the articulation and arrangement of the teeth, is a decided disadvantage.

Without expressing any opinion of its practicability, we think it is a good thing to know, and may prove quite useful. In changing the springs on a Coffin plate, for instance; or in some repairing cases, it may be valuable.

Quite a long time ago, Dr. Theodore F. Chupein, of Philadelphia, called attention to the usefulness of vulcanizable rubber dissolved in chloroform and evaporated to the consistence of a thick syrup as a cement for repairing articles made of rubber; for instance, he repaired the bulb of a syringe, by painting it with the cement, and immediately covering the injury with a piece of vulcanizable rubber. He found many useful applications of this cement in his laboratory.

DISCUSSION.

DR. HASKELL: In the first place, with regard to artificial dentures in general, I have seen dentists before now who did not seem really to appreciate what vast differences there were in the mouths of certain patients. Patients will sometimes say, "Why can't I have a set of teeth that wear as well as Mrs. So-and-So's?" I reply, "Simply because you have not got Mrs. So-and-So's mouth." There are some mouths into which you can almost throw a set of teeth and have them a success, and others will require all the skill that can be brought to bear, and all the patience that the patient can exercise to bring the set into successful use. It is not difficult to insert an upper set of teeth in a mouth successfully when there is a good alveolar process, not too deep a palate, nor too hard, and where the lower jaw strikes squarely under; but the next case may be one where the conditions are all unfavorable—where the process has entirely disappeared and a flexible ridge remains, with the palate flat and very hard. And these cases are occurring to a fearful extent under the use of vulcanized rubber, on account of its non-conductibility. The less air can circulate under the plate the worse it is. If the suction is good and the plate adheres firmly and the air cannot circulate, the heat is retained, the membrane is inflamed, and in consequence of the abnormal condition of things the waste material that is carried off is not replaced. I was speaking of a mouth where the process was all gone. In addition to that the palate may be a very small one, and the lower jaw closing a quarter or a half of an inch outside of the upper jaw. In such a case the greatest care must be exercised, not only in fitting the plate, but especially in antagonizing the teeth. I have seen many plates in the mouth where the failure to antagonize rendered the teeth worthless, which by grinding and antagonizing were made quite useful. When the patient has reached that condition of things where he or she must wear a partial denture, the question arises what teeth shall be retained and what teeth removed. A simple rule that I have adopted and which I think is a safe one is, remove from the mouth whatever teeth are necessary to make the artificial denture as comfortable and as useful as possible, throwing aside all sentimentality with regard to extracting sound teeth.

While rubber is universally used, it is the worst material that is put into the mouth except celluloid, by reason of its non-conductibility. On the other hand, all metals are conductors of heat, and consequently preferable in the mouth. It is often said that un-

due absorption takes place in the mouth under the metal plates. It is true, but as a rule this is due to undue pressure at some point, usually in front; but those are exceptional cases. So if it is possible to induce your patient to have a metal plate do so. It is often said by dentists, "I have no demand for metal plates." Create a demand. It is for you to create a demand. Your patients never will do it You must inform your patients with regard to these matters, educate them up to the point of wearing metal plates, and there is not a community in which some cannot be thus educated.

I want to give a few points in regard to impressions, casts, and so on. For taking impressions I know many use other materials besides plaster. I simply say in regard to that that I have no use for anything but plaster. I find I can always rely upon a plaster impression. With regard to the preparation of casts, in the first place, I use no air-chamber. It is of the utmost importance that your plate should not press against the hard palate. That I raise with a thin film of wax, the edge chamfered off so that it is undefined. You may call that an air-chamber; perhaps it is. If the mouth is not hard in the center, I fit the plate to the entire surface. Bevel the sides of the cast so it will drop from the mold readily. For dies there is one metal, and so far as I know but one metal, that has all the requisites for a dental die, and that is what is known as Babbitt-metal. The requisites for a dental die are these: Non-shrinkage, hardness, toughness, smoothness, and melting at a low temperature. You have all these in Babbitt-metal: but you want to be sure that you have a proper Babbitt-metal. One that costs less than 40 cents a pound is of no account, for the reason that materials have been put into it to cheapen it which spoil it for dental dies. Take the Babbitt-metal such as you can buy of the White Manufacturing Company, Justi, and the Chicago Dental Company, and you will have a metal made according to this formula: One part copper, two of antimony, and eight of tin, melted in the order named. To make counter dies add something to your lead to reduce the melting point; say an eighth or a sixth of tin. Pure lead is also too soft for a die. By adding tin you harden it as well as reduce its melting point.

With regard to bridge-work and teeth without plates, I wish to say, in the first place, that I consider what is called bridge-work is doing incalculable injury. The crowns of teeth are being ruined by that process. It is absolutely impossible to keep the portion of the denture, plate or no plate, that comes in contact with the gum, clean.

I have removed them from the mouth and placed them in the patients' hands, and they were disgusted to think they had had such things in their mouths. A sound tooth is covered with a gold band. Of course the band does not fit the tooth, so it is attached with cement. How long does the cement remain there? Use in mastication will wear that loose and it will disintegrate so that more or less of it will come out. The fluids and secretions of the mouth go in to stay. What is the result? The tooth is completely girdled with decay. Another result of an artificial denture fastened in this way to a natural tooth which is being masticated on, is that it finally becomes permanently loosened and worthless. Thousands of teeth are being ruined in that way. The least objectionable form of such work that I have seen is the work that Dr. Parmly Brown presented to you. I should say that in some cases that would be advisable and would do no harm. I would use it as a last resort. A narrow gold plate properly adjusted to the mouth and attached with clasps and kept clean does no harm. That plate can be removed to be cleansed, and a cleanly patient will see that it is kept clean. The plate has a bearing on the gum and the whole strain does not come on the natural teeth.

Dr. Ames: Until such time as our fellow-mortals shall cease to need the adjustment of entire dentures upon edentulous jaws, the satisfactory retention of such appliances will be one of the important subjects for consideration in this Section.

These dentures must be sustained, if sustained at all satisfactorily, either by the use of spiral springs or by the pressure of the atmosphere. The spiral springs being so seldom required I will say nothing of their use. A quite universal method of taking advantage of the pressure of the atmosphere is by the formation of a chamber over the palatal portion of the denture where, by the partial evacuation of its contents an unequal atmospheric pressure is produced, giving some support. If this support be at all considerable the tissues soon entirely fill the chamber, if it be a shallow one, as the natural result of constant traction upon them, and while making use of this method I found that more support could be obtained from a shallow cavity than from a deep one, for the reason that, air being expansible the greater the quantity contained within the chamber the easier it is expanded sufficiently to allow the denture to entirely leave the surface of the jaw.

This method I abandoned some time since, and now give preferance to one by which a denture is constructed devoid of any cham-

ber or space whatever between it and the surface of the jaw. A few dentists employ methods by which dentures are similarly constructed, but I have never seen or heard a statement from any of them giving definite rules or instructions for the construction of such dentures in such a way as to not only equalize the bearing but also to procure a powerful atmospheric pressure just where needed, and there only.

You all understand the methods of trimming the impression and model for the distribution of the bearing of the denture upon the surfaces of the jaw, which are of variable resistance, but this is not sufficient to obtain the best results. The plate must extend in all directions to a point where its edge can be made to slightly displace lax tissues. I mean by this that it must extend posteriorly to a point where the soft tissues of the palate are sufficiently lax to allow of slight displacement by the edge of the plate, and that it must extend well up beneath the lip and cheeks so that they lie snugly upon its edge.

In this you have a denture which does not exert any perceptible traction upon the tissues when in position, but immediately upon its displacement from contact with any part of the surface of the jaw, atmospheric pressure is produced over such part, from the fact that all edges of the denture are slightly displacing lax tissues which follow the edge downward and prevent the entrance of air between the denture and jaw. After constructing a denture upon this principle, I find it necessary to instruct the patient, when removing it, to raise the lip free of the edge, thus admitting air.

Dr. Morgan: I wish to notice one or two errors that my friend Dr. Haskell made which I think are fundamental. I do not wish to appear here as the champion of rubber, for I recognize, as you all do, that in many respects it has been a damage to our profession and to the public, and in many respects it is a very poor article as a basis for artificial teeth, and that in many mouths you meet with difficulties that you would not if your patient had been wearing gold. The doctor spoke of undue heat in the mouth due to the use of rubber. I think he is mistaken. Mucous membrane is not the eliminator of heat in the body. You never get the mucous membrane above blood heat until you have irritation and inflammation. It is impossible that heat should be eliminated from the general system and held in the mouth so that the heat of the mouth will be above the heat of the body. He must go further back than that before he comes to the prime difficulty which results in the production of the

large amount of loose tissue which is frequently found upon the alveolar borders, especially in the front part of the mouth. I recognize that this condition is frequently met with, and that it is a serious difficulty in the way of adapting artificial dentures so as to make them serviceable.

He said also "all natural teeth should be removed that interfere with the comfort of the artificial denture." Suppose you had occasion to insert upon a plate two superior incisors. Every one knows who has had experience that if the remaining teeth were removed a substitute could be adapted that could be worn with much greater comfort than could the one carrying only the two teeth. Should he take them out? I think not. The principle that the comfort and usefulness of the natural teeth that remain in the mouth are not to be considered, and all of them are to be removed that interfere with the comfort of the artificial denture is an incorrect one.

I agree fully with him that metallic plates are worn with much more comfort to the patient than those made from rubber, as a general rule.

Dr. Horton: The last speaker claimed that there was a misapprehension on the part of Dr. Haskell as to the cause of the loose tissue referred to. Will he please give us a little information as to what he thinks is the real cause?

Dr. Morgan: I do not know why it is so. I believe it occurs more frequently under rubber than metallic plates, but the cause lies back of the retention of heat.

Dr. Atkinson: There has so much error been promulgated to-night that I cannot forbear speaking. I should judge from the remarks of the gentleman from Chicago, whose reputation as an artificial workman is universal, that he had never seen a properly constructed bridge-piece. If we were to confine our observations to Washington's teeth, we might condemn the whole of dentistry. If the gentleman had seen one single well-constructed bridge-piece he could not condemn such work as he has done to-night. If he will come to New York I will show him some clean mouths that have worn all the various kinds of appliances, from gold down to that delightful thing (to some minds) rubber. I will show him the pieces in the mouths where there is a perfect restoration, simply by putting in bridge-pieces. But you must have your bridge-piece attached intelligently, and the great mistake among men who are using bridge-work is that they are not physiologists nor pathologists; they do not know when they have the mouth in a condition

to bear the insertion. They are not judges of artistic and mechanical appliances, and do not know when they have the teeth properly occluded so that each tooth shall do its proper share of work.

As to this rubber business, gentlemen talk with their mouths open when they defend rubber and say it cannot produce heat, but it must produce irritation. No man can tell when the primal irritation occurs. The great curse of rubber is that it anesthetizes the sensory nerves by reason of its non-conductibility. It then paralyzes the vaso-motor nerves in that little group of capillaries in the gum, so as to allow the blood to flow in and remain in little lakes, and instead of retrograde metamorphosis, we have these mugwump mouths that are not satisfied with the correct order of things, but go wiggling all around, not closing twice alike.

Dr. Haskell: Dr. Atkinson has so admirably answered Dr. Morgan in regard to the effect of rubber in the mouth that it is not necessary for me to say anything. In regard to the case which Dr. Morgan cited, he seemed to think that I meant that it was necessary to extract all the remaining teeth. That is an extreme case, because two teeth could be put in and made comfortable and useful without extracting any other teeth. I should have said, in partial cases where many teeth are missing. In reference to Dr. Atkinson's remarks with respect to bridge-work, I excepted the very method that Dr. Atkinson advocated, as introduced by Dr. Parmly Brown, and said that that was the most favorable form that I had ever seen of bridge-work. It certainly is the most cleanly.

Dr. Morgan: I would like to ask Dr. Atkinson if he meant to say increase of the heat in the mouth above the heat of the body would occur without irritation?

Dr. Atkinson: No, I did not. I did say that irritation could not be perceived by any means known to me until after it had passed beyond the point of irritation and induced retrogressive metamorphosis of the tissues.

Dr. Morgan: That is what I meant to say,—that you had no increase of heat from any plate in the mouth until there was irritation and the beginning of inflammation, and Dr. Atkinson, instead of combating the idea which I advanced, exactly confirms it.

Dr. Spalding: If gentlemen will take the trouble to test the actual temperature of the mucous membrane under rubber plates, and test it under gold plates, and test it without a plate, I will venture to say that they will not find the fourth part of a degree of difference in the temperature. The claim that heat is generated

under such circumstances can easily be determined by the application of the thermometer.

Dr. Brophy: It has been well said that the tissues beneath the plate become inflamed. Why is it? It is simply for this reason: rubber not being a good conductor of heat or cold, the capillaries of the vessels beyond that portion of the membrane covered by the plate contract when hot or cold substances come in contact with them, while those immediately beneath the plate do not. The consequence inevitably must be that the blood rushes for the capillaries which are dilated, and they are overcharged. This produces what Dr. Atkinson said you will find, little lakes of blood beneath the plate, and then follow congestion and absorption of the alveolar process. Micro-organisms may be another cause. Almost any plate is covered with them, and they in time produce irritation.

Dr. Spalding: The ordinary and simple reason why the mucous membrane is irritated under the rubber plate is because the surface of the plate is not smooth. It arises from mechanical irritation owing to the roughness of the plate. Any rough surface applied to the mucous membrane will eventually produce irritation and inflammation.

Dr. Barrett: Dr. Spalding will find if he polishes the inner sur- of the rubber plate he will simply aggravate the disturbance. That is practical common sense and practical experience.

Dr. Atkinson: It is the shutting up of the mucous follicles that is the immediate antecedent of the mischief, so that those people who persist in wearing plates during their sleeping hours, and do not give the mucous follicles opportunity for breathing at least a part of the time, may expect that the inception of the mischief has already set in.

SECTION II.

Dental Education.

Report by A. O. HUNT, Chairman.

THE cause of dental education has progressed rapidly in the last year, more so, perhaps, than in any past year, as evidenced by the increase in membership of every State and local society, as well as the unprecedented increase of the membership of this body. The improvement is not wholly in numbers, but also in the quality of the persons themselves.

We can only continue the report of last year from this Section by adding to it the work of the National Association of Dental Faculties, which held its meeting in Chicago last week. Two new colleges were added to the list.

At this meeting a movement was made in the direction of improving the literature of dental science, so that our books of reference and text-books may be in full keeping with the rapid advancement of our profession. The following resolutions were adopted for 1884:

Resolved, That after the session of 1884–5, the colleges belonging to this association shall require attendance upon two full courses of lectures previous to the students coming forward for graduation; provided, that these two courses shall have been attended in separate years.

Resolved, That after the session of 1884–5, the possession of a medical diploma from a reputable medical school be accepted as equivalent to one course in dentistry, the holder being required to pass one year in a dental infirmary, the year's study to include a course of lectures in a dental college, before coming up for graduation.

Resolved, That one course in a medical college be accepted as equivalent to one year's pupilage in a dental office, but one-year medical students shall be required to attend two regular courses of lectures in a dental school.

Resolved, That we recommend that a preliminary examination be required for entrance to our dental colleges. Such requirements shall include a good English education. Candidates holding the diploma of a recognized college, academy, normal or high school, or other evidence of literary qualification, may be received

without examination. In case of any applicant failing to pass a satisfactory preliminary examination, the other colleges of this association may be informed of the fact.

Resolved, That we agree to adopt a graded course of instruction and an intermediate examination, which course of instruction and examination shall be conducted as the faculties of the different colleges in this association may deem proper.

We recommend that the following subjects and arrangement be adopted by the colleges of this association, viz.: First year—Anatomy, with dissections, Physiology, Histology, Chemistry, didactical and practical, Mechanical Dentistry. Second year—Review of junior-year studies, Pathology, Surgery, Materia Medica, Therapeutics, and Operative Dentistry.

The following additional resolutions were adopted in 1885:

Resolved, That the colleges of this Association will receive into the senior classes only such juniors as hold certificates of having passed a satisfactory examination in the studies of junior year; this certificate to be a pledge to any college to which they may apply that a previous term has been properly spent in the institution whence they come.

The above resolution shall not apply to candidates holding diplomas from reputable medical schools who apply for admission to the senior classes.

Resolved, That applicants for admission to our senior classes from foreign countries shall be required to furnish properly-attested evidence of study, attendance upon lectures, etc., the same as is required of junior students; and they shall also pass the intermediate examination.

Resolved, That the fees of all dental colleges, as far as possible, be uniform.

Resolved, That a preliminary examination be required for entrance to our dental colleges; such requirements shall include a good English education. In case of any applicant failing to pass a satisfactory preliminary examination, the other colleges of this association may be informed of the fact.

Resolved, that a candidate for matriculation who presents a diploma from a reputable literary institution, or other evidence of literary qualification, shall be admitted without further examination.

Resolved, That for preliminary examinations we recommend the following questions:

1. Write your name in full.
2. Give date of birth,—day, month, year.
3. Where were you born? Town, County, State.
4. Where do you now reside? Town, County, State.
5. What educational advantages have you had? Name the schools you have attended, and the time spent in each.
6. What branches have you studied, and to what extent have you pursued them?
7. In what occupation have you been engaged other than that of student, and how long were you thus employed?
8. When did you commence studying dentistry? Month, year.
9. How many months of actual medical and dental study have you had to date?

10. Have you attended a full course at any medical or dental school? If so, where and when?

11. With what preceptor, or preceptors, have you studied? Give name and present residence.

Sign your name in full.

Write an English composition of at least two hundred words, upon a subject of the examiners' selection.

Further examination to be left to the judgment of the different faculties. The examination proposed is to embrace the following: 1, English Grammar; 2, Arithmetic; 3, Geography; 4, Modern History; 5, Government Topics.

A failure to pass the examinations may be communicated to other colleges.

A committee, consisting of Professors Taft, Ingersoll, and Harlan, was appointed to prepare a schedule of questions for the preliminary examinations.

The following resolution was adopted:

Resolved, That no college shall give credit for a full term to any student who has entered later than twenty days after the beginning of regular lectures.

The following form of certificate to be given to students who pass the intermediate examination was adopted:

This certifies that —— —— has attended one full course at the —— —— ——.

He was absent from lectures —— weeks.

He was absent from practical work —— weeks.

He was examined at the close of the session, and was found qualified to enter the senior class.

Each student completing one regular course in any college in this association shall be furnished with the above certificate, without presentation of which he shall not be accepted by any of our colleges for admission to the senior class.

VOLUNTARY PAPER.

The Past, Present, and Future of Dentistry.

VOLUNTARY PAPER BY E. PARMLY BROWN.

The profession of dentistry a few years ago was deemed of low estate, and looked upon as almost a vulgar occupation by the masses; but now, impregnated with learning and art, its genius is stimulated and it has become of good repute, holding a position which we trust will be maintained while man peoples mother earth. Dentistry is a scientific art; it is made up of a greater percentage of that which is strictly artistic in the execution of its practice than of anything else. Science holds a large place in the proper preparation of the dentist and his successful work. Medicine is almost a pure science, surgery an artistic science.

The evolution of dentistry from its despised condition may be likened to that of the common thistle, which, when crossed with brilliant-hued plants, drops the pricker, discards its evil points, and gives us the beautiful coleus of to-day,—the most luxuriant garden and lawn illuminator that nature, aided by horticulture, has ever produced. Dentistry as it was, the common handicraft thistle of the past with its many points of abhorrence, ingrafted with science gives us the dental art of which we are so proud, and of which the world shows its substantial admiration and appreciation.

We are not a part of anything, but a something complete within itself; closely allied to medicine and surgery, but principally what they are not—operative and artistic dentists—and until the dental art, as now taught to the dental students, is taught to all medical students (which will never come to pass), dentistry will never be a specialty of medicine. The dentist is like the oculist and optician combined. His oculistic part (oral surgery) is medicine's specialty, his optician part (dental art) is not in the M. D. curriculum. The nature of the case does not permit that it ever can be. To study

and practice medicine and dentistry successfully, in competition with the present divisions of the labor, is more than one body and brain can stand. The tide is flowing the other way. There is too much in dentistry for even a superior genius to master. The specialties in dentistry,—dental surgery, operative dentistry, prosthetic dentistry, anesthetic dentistry, and regulative dentistry,—show that though fond of cutting yet are we being carved up into many subdivisions to satisfy the demands of a hungry public.

The days of the stage-coach in dentistry have passed; already the lightning is held with curb-bit to obey the operator's will. The possibilities of the future you may dream of and surmise, but no man can predict. The age of slow progress is buried deep beneath the ground where grows the tree of knowledge and advancement; the carcass of the past is fertilizing the luxuriant growth of the present; the lightning flashes around the world in the twinkling of an eye, enlightening the nations; night is turned into day; distance is almost annihilated, and the microscope makes the atom visible. Steam is photographing the brains of men of progress and hurling the imprints over the surface of the earth, like downy seed carried on the wings of the hurricane, that good knowledge may take root, sprout, bud, and bloom into blessings to mankind. Steam is hurling the head and hand of expertness here, there, and everywhere, that man may see, hear, and learn.

A visionary prophet would he be indeed who would predict the dentistry of fifty years hence. Look back a half century and see the hopeless task it would have been to have painted the picture of the present.

Putting your shoulder to the wheel makes progress. Many shoulders to the wheel make much progress. Let us all resolve that our shoulders shall do their duty. Let us steer between the two strands of wearing out and rusting out; then will we be sure of holding out.

The successful dentist of the future must be an educated and polished gentleman, in addition to being a master of his profession.

The lady of the near future will select, with jealous care, the physician who guards from harm her oral case of jewels rare; and with ten times the fastidiousness that she selects the physician who assists her in augmenting her posterity.

The archimedian lever that will elevate honest effort and ability is the reduction of the amount of work we do, and the increase of the fees.

He is violating the laws of physiology, philosophy, and Christianity who labors unceasingly, and is transmitting an evil influence to those around him and to posterity, which will more than undo his life of toil. The wife of Charles Dickens said, "It may be necessary for the world to have its great geniuses, but it is a terrible thing to live with one." Dickens died more than twenty years before the time a true philosoper should allow his heirs the pleasure of dividing his estate.

If there is wisdom in making one's self miserable in trying to be happy, then there is wisdom in over-work. Dickens poured out every drop of his affection in his literary works, and there was no kind word left for those who claimed it most.

Herbert Spencer predicts that the amalgamation of the races, under such favorable surroundings as are found in America, will, in a few generations, produce a superior race of beings. With the dental ascendency that America possesses to-day, what must be the result in a few generations on a people educated to treasure their teeth as pearls of priceless value? Without which preservation a people cannot be truly healthy and happy, and consequently great.

"Sunlight," "sunlight," our cry has been, our cry should ever be, and cursed will the dentist be who does without it,—a sickly plant, a withering, stunted tree.

Dentistry: It began in the early ages, in its night of utter darkness.

Time rolled on, and toothache tormented man with its terrors; until some semi-civilized creature molded the tallow candle of dental advancement.

Then oil was poured upon the troubled waters, and set ablaze with the friction match of still further progress; until gas lighted our profession more surely in the path of science.

Now we have arrived at the dazzling electric light era of our existence, and the Edisons of the dental profession are lighting up the dark corners of ignorance, constructing ingenious appliances, and investigating minutely everything but the infinite.

The ideal dentistry will only be universally practiced when all other things good for man's advancement are also in pace with it; an appreciative public making a demand for it can alone produce it.

STANDING RESOLUTIONS.

The following standing resolutions are in force at this time, August, 1886.

Resolved, That henceforth no person shall be received as a delegate who is in arrears for dues, or until he has paid to the Treasurer the full amount due at the time his name was dropped for non-payment.

Adopted August, 1874.

Resolved, That hereafter no dental college shall be entitled to representation in this Association that does not require a good English education as a preliminary qualification for its matriculants, to be ascertained by examination.

Adopted August, 1879.

Resolved, That in order to secure representation in this Association, dental colleges must, subsequent to October, 1881, require all students entering therein to take two full courses of lectures previous to coming forward for examination and graduation, and must also state these conditions in their next annual announcement.

Adopted August, 1880.

Resolved, That hereafter no society shall be entitled to representation in this Association that does not require its members to live up to the requirements of our Code of Ethics.

Resolved, When it comes to the knowledge of the Committee on Credentials that any applicant for membership is violating our Code, said applicant shall not be received, and all such applicants shall be referred by the committee to the societies whose delegates they are, and in no case shall this Association be compelled to treat with violations of the Code, except where the violator is a member of this body and has no membership in any local society.

Adopted 1881.

Resolved, That the Secretary be instructed to assign members who may neglect to make their own choice the Section in which they are expected to work.

Adopted 1879.

Resolved, That the reports of Sections shall be called by the President in consecutive order, beginning each succeeding year one number higher that on the preceding year.

1879	commencing	with	No. I.
1880	"	"	No. II.
1881	"	"	No. III.
1882	"	"	No. IV.
1883	"	"	No. V.
1884	"	"	No. VI.
1885	"	"	No. VII.
1886	"	"	No. I.

Adopted 1879.

Resolved, That a paper presented to the Committee on Voluntary Essays and by them considered and returned to the writer with notification that the said paper is not accepted, cannot afterwards be read before the Association unless it is made the special order by resolution adopted.

Adopted 1885.